

• SCIENCE AND THE CHURCH •

J. A. ZAHM.

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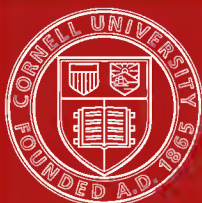
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SCIENCE AND THE CHURCH

BY

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and Dogma," etc.

Conficitur inde veram philosophiam esse veram religionem, conver-
simque veram religionem esse veram philosophiam.
— SCOTUS ERIGENA.

The outward form of Truth may Science see
Revealed to eager sight;
To feel her throbbing heart fair Faith alone
May claim as sacred right.

But he who reads by Science and by Faith
Creation's God-writ scroll,
Enraptured stands before the beauty held
In Truth's unchanging soul.

CHICAGO

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1896

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TO
B. I. C. E.

PREFACE.

THE present work is composed of articles which have at various times appeared in divers periodicals, religious and secular. With the exception of a few omissions and a few verbal changes here and there, they all retain their original form. They are published in book form in response to numerous requests from both the clergy and the laity, and it is hoped that the resulting volume will be of service to all who are interested in the subjects therein discussed.

For permission to reprint the articles now collected together, I am indebted to the courtesy of the editors of *The North American Review*, *The Cosmopolitan Magazine*, *The Catholic World*, *The Rosary*, *Donahoe's Magazine*, *The American Ecclesiastical Review* and *The Bulletin* of the Catholic University of America.

J. A. ZAHM, C.S.C.

NOTRE DAME UNIVERSITY.

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SCIENCE AND THE CHURCH.

CHAPTER I.

LEO XIII. AND SCIENCE.

AFTER an extended audience with the Pope toward the close of the year 1894, Emilio Castelar, Spain's brilliant orator and statesman, did not hesitate to declare: "I have seen all the great men of my time, but Leo XIII. is the greatest of them all." He was not, however, satisfied with this declaration, complimentary as it is to the Sovereign Pontiff; he went even further. "Our century," he continued, "has seen only two really great men: Napoleon Bonaparte, at the beginning, and Leo XIII., at the close."

These words are indeed high praise, and to some they may seem even extravagant; but are they extravagant? Aside from being a philosopher and a historian, well versed in politics and statecraft, a good judge of men and things, Castelar has had opportunities for comparing the relative merits of the great men of the century, that have been enjoyed by but few in the same degree. It cannot be urged that the eminent republican leader was prejudiced in favor of

the prisoner of the Vatican. On the contrary, if he had any bias at all, and I am not sure that he had none, it predisposed him against, rather than in favor of, the object of his lavish and enthusiastic eulogy. He has pronounced many harsh judgments on the Church, and has at times been rather severe on the Papacy. That he has not always entertained the same high opinion of the present occupant of the Chair of Peter as the one he now holds is manifest from the surprise which was expressed on all sides when, after his audience with the Pope, he gave to the world his impressions of the illustrious Pontiff now happily reigning. His testimony, therefore, is that of a true and intelligent witness.

And then, too, we must remember that Castelar is not alone in his estimate of the grand old man of the Vatican.¹ No one who has carefully watched his career since he ascended the Pontifical throne, or who has come in contact with him and had an opportunity of conversing with him on important affairs of church or state, will make any difficulty in admitting that the illustrious Spaniard's verdict is substantially, if not entirely, true.

It would be no easy matter to enumerate all the present Pope's titles to greatness. Some men are

¹ Since the above was written, Prince Bismarck, in speaking to a delegation of students who had called upon him, has declared that "the greatest statesman in Europe to-day is Pope Leo. In a recent article in *La Revue de Paris*, M. E. Spuller, ex-minister of the French Cabinet, asserts that "To enemies and friends Leo XIII. stands on the pinnacle of human greatness."

born great, and others achieve greatness by their own individual efforts. Leo XIII. was born great, inasmuch as he was richly endowed with all those qualities of mind and heart which are essential to true greatness. But it is the greatness he achieved by his long, tireless, and well-directed labors in the cause of truth and in the service of his fellow-men that specially arrests our attention. We may admire the many rare intellectual gifts with which Providence dowered him, but we marvel still more at the noble use which he made of his priceless talents. Heaven was bounteous, even prodigal, in his regard, but the riches which were showered upon him were neither dissipated nor permitted to lie idle. All were conscientiously, and systematically, and persistently employed in the cause of science and humanity, and were made to multiply a hundred, yea, a thousand fold. Few men, indeed, have husbanded with more care and to better purpose the spiritual and intellectual treasures with which they have been favored; and few, too, at the sunset of life have been able to look back over a more successful or a more brilliant career, or one more remarkable for untiring devotion to the welfare of their race and to the advancement of all branches of knowledge, sacred or profane.

It were a difficult task to indicate exactly wherein the world is chiefly Leo XIII.'s debtor. He has done so much for humanity; he has labored so long and so unselfishly for its betterment and elevation; he has striven so earnestly and so courageously for

the triumph of truth and justice that he has extorted the admiration and earned the gratitude of all, irrespective of nationality or creed. During the whole of his phenomenally long and active life he has directed his best efforts toward the promotion of peace and good-will among men, and toward the alleviation of the sufferings and miseries of the vast and neglected world of poverty and labor. The laboring classes, indeed, never had a more valiant champion, and the poor have never known a more loyal and sympathetic friend or protector than the venerable Pontiff of the Vatican.

It is not, however, of Leo XIII. as an accomplished statesman, as the illustrious exponent of Christian socialism, as the benefactor of the suffering poor, as the advocate of the outcast and down-trodden, as the defender of the rights of the millions of wage-earners of the Old and of the New World, of whom I would now speak. His claims to recognition for all these things are too well known to make it necessary to dwell on them here. I would speak of Leo XIII. as the scholar among scholars; the intellectual Pope of an intellectual age; as the founder of schools and universities in a great scholastic era; as the fautor-in-chief of science and philosophy in a century of science; as the grand Pontifical Mæcenas of the scientific renaissance of which the Church and the world at large have already felt the influence, and experienced the beneficent results.

In speaking of Leo XIII. as the friend and pro-

moter of science, I shall employ the word "science" not in its restricted and inexact sense, as referring only to the physical and natural sciences—"the physical disciplines," they are more appropriately called—but in its true and broader signification. "Science," as here used, shall have the meaning attached to the term by Plato and Aristotle, viz., the knowledge of things through their causes—*cognitio rerum per causas*—and shall, consequently, embrace the whole circle of the sciences, deductive as well as inductive.¹

From his earliest youth Leo XIII. had a love of learning that amounted to a passion. He was always a close and thorough student, and the profundity of his knowledge was equaled only by the variety of his attainments and the delicacy of his taste. He was soon recognized as an accomplished Latinist, and signalized as a master of his own beautiful vernacular, who had few, if any, superiors among his contemporaries. A distinguished Italian litterateur, Enrico Valle, has declared that in the poems of Leo XIII. are combined, in a marvelous manner, the elegance of Virgil, the delicacy of Catullus, and the grace of Tibullus. But he is no less a master of versification in the language of Petrarch and Dante than in that of Virgil.

The gifted singer of Mantua and the great Flor-

¹ The schoolmen defined science as "*cognitio certa et evidens rerum per suas causas naturali lumine acquisita*," a certain and evident knowledge of things through their causes, acquired by the natural powers of reason.

entire bard have always been special favorites of his, and few have greater admiration for, or a keener perception of, the beauties of these matchless poets than has the present occupant of the Papal chair.

During the thirty years that he administered with such signal success the diocese of Perugia, he showed forth to the world how much he had at heart the cause of education and the advancement of science. It was here, indeed, that he evinced that passionate ardor for the dissemination of knowledge and for the cultivation of the higher branches of every department of science that was to shine forth so conspicuously in him as Pope, and which was destined to contribute such luster to his pontificate. Everywhere, he founded schools and colleges, and was foremost in instituting societies and congresses for the encouragement of study and for the discussion of the burning questions of the hour.

To realize how thoroughly in earnest he was in the all-important work of education, we have only to read the noble pastoral letters which he wrote while yet known as Monsignor Joachim Pecci. We find in these the dominant notes of those clear bugle-calls to action which have attracted such attention in the briefs and encyclicals of the same writer after he was elevated to the pontifical throne. But it is especially when he discourses on the education of the clergy that he is seen at his best. He would have them masters not only of sacred, but of profane science, as well. He realizes, and he does not hesitate to de-

clare it, that in the times in which we live, a knowledge of the physical and natural sciences is, for the ecclesiastic, not only an accomplishment which may be more or less useful, but that it is a positive necessity. For, on the priest he tells us it is incumbent to defend truth against error; to strengthen the weak and vacillating, and to open the eyes of those who "sit in the darkness of the shadow of death." But for such an one, superficial science and ordinary knowledge are not sufficient. Solid, deep, and continual studies are required in order that he may cope with any assurance of success with the skilled adversaries which he can now no longer avoid.¹

¹ In the year 1849 the bishops of Umbria assembled in council at Spolletto, and among other things which came up for their consideration and adoption was a program of studies proposed by Monsignor Pecci. A brief extract from the acts bearing on his program, will exhibit the mind of the future Pope regarding the studies of ecclesiastics better than would any words of mine.

"Ac primo non est cur hic eloquamur quid quantique intersit Clericos scientia pollere; quum luculentissime ex eo pateat quod sacræ Litteræ, SS. Patres, et cujusvis ætatis Concilia scientiam ab Ecclesiæ Ministris conceptis verbis exquirant. Ejus autem necessitas hac potissimum tempestate elucet, qua tot conatibus adversus veritatem quoquomodo adhibitis sit opus occurrere. Quis enim ignorat incredulos non sacra solum Biblia depravare, sed Physiologia quoque, Chimica, Mineralogia, Diplomatica, Cronologia, aliisque naturalibus facultatibus ad multorum perditionem indesinenter abuti? Ac propterea quis non intelligit plenam notitiam earum facultatum, quae olim veluti voluptuosæ soliusve ornamenti reputabantur, Clericis hodie nedum perutilem, sed et pene necessariam esse?

"Ex quo plane consequitur hisce temporibus Clerum, præter scientias ecclesiasticum statum proximius spectantes, ceteris quoque instrui oportere. Quamquam vero hoc sperare nonisi a Clericis præstantioris ingenii, et ex istis paucissimis, aut forte neminem invenire liceat, qui perfectam assequatur notionem omnium facultatum in studiorum curriculo mox describendo comprehensarum; Sacro nihilominus Consessui

Progress is something that, far from fearing or restraining, he welcomes with all the energy of his soul. In a pastoral letter which he wrote shortly before the assembling of the Vatican Council, he answers as follows the objections of those who imagined that one of the first acts of the Council would be to put a brake upon the progress of the age :

“ If by progress is understood discoveries and inventions, and the development of the sciences and the arts, oh ! then be assured that there will be no opposition whatever. Revealed dogmas and the holy truths of religion belong, indeed, to a higher order than do mere natural verities, but the former cannot contradict the latter, for both emanate from the one sole principle, which is the essential truth, God himself. If the word “progress” designate the ordinary rules of modern life, and if these rules be in accord with Christian morality, it is impossible that the Council should not give them even greater force and authority than they now possess, since one of its chief objects is to proclaim, protect, and maintain on solid foundations the guiding principles of public and private morality.”

apprime expedire visum est, ut talis studiorum ratio proponatur, qua in Clericorum universitate, licet suam quisque pro ingenii viribus colat, semper variarum scientiarum complexus cumulusque maneat ex opportunitate excolendarum, ita quidem ut quilibet ex Episcopis ecclesiasticos viros in unaquaque facultate rite doctos sibi comparare, eorumque opera, ubi occasio postulaverit, uti queat ad errores, quamcumque induerint formam, redarguendos et refellendos.”

“Œuvres Pastorales de S. E. le Cardinal Joachim Pecci, Archevêque—Evêque de Perouse,” Desclée de Brouwer et Cie, Lille.

The same idea he develops more at length, and with still greater eloquence in his celebrated pastoral on "The Church and Civilization." Commenting on the objection, so frequently urged by those who should know better, that the Church is hostile, or, at least, indifferent to the studies and investigations which have conferred such untold benefits on our race, he declares that there is no warrant whatever for the statement that, "The Church is opposed to the study of nature, and of those forces whose application to the arts of life has contributed so materially to our common weal. A moment's reflection should suffice to convince any one that the Church, far from being hostile to scientific researches and inventions, is disposed by the very nature of things to encourage and foster their development."

"Examine and judge for yourselves. Can the Church desire anything more ardently than she desires the glory of God and that more perfect knowledge of the Divine Artificer, which is obtained by a study of His works? But if the universe is a book, on every page of which are inscribed the name and wisdom of God, it is evident that the one who shall have read this book most carefully and intelligently will be the one who will be filled with the greatest love of God, and who will approach most nearly unto Him. If it suffices to have eyes to see that the starry Heavens show forth the glory of their Creator; if it is sufficient to have ears to hear the concert of praise which day giveth unto day, to understand the

secrets of Divine knowledge which night declareth unto night, how much more clearly and strikingly shall not the power and the wisdom of the Divinity be manifested to those whose scrutinizing gaze shall explore the distant heavens and the depths of the earth, whose enquiring minds shall range from infinitesimal atoms to the shining orbs of space; whose keen intellects shall search out the manifold mysteries of the vegetable world and bring home to themselves the countless evidences of the Supreme Intelligence that has ordered all things in number and measure and weight?"

Further on, with a beauty of diction all his own, he indites a passage which even the most eloquent of our scientific writers have never surpassed. "How grand and majestic is man when he commands the thunderbolt and causes it to fall harmless at his feet; when he summons the electric flash and sends it as the messenger of his will, through the depths of the ocean, over precipitous mountains and across boundless deserts! How he is seen in his glory when he orders the force of steam to invest him, as it were, with wings and conduct him with lightning speed across the broad expanse of land and sea! How powerful he appears when, by ingenious contrivances, he develops this force itself, imprisons it and, by means of marvelously designed appliances, gives movement and intelligence, so to speak, to brute matter and bids it be his servant and spare him further toil and fatigue! Tell me, my brethren, is

there not in man some spark of creative power, when he evokes light that it may dispel the darkness of night and give beauty and splendor to his vast and palatial abodes! The Church, our affectionate mother, is cognizant of all this progress, and far from desiring to impede it in any way she, on the contrary, at the very sight of it, is thrilled with joy and gladness." It is scarcely an exaggeration to declare that it was, humanly speaking, Cardinal Pecci's magnificent pastoral on "The Church and Civilization" that made him Pope. It appeared on the eve of the meeting of the Conclave to choose a successor to Pius IX., and it signalized its author as the one man, among the princes of the Church, who, by reason of his varied and profound learning, his intimate knowledge of men and affairs, his thorough realization of the needs of his age, and his unquestioned talent and virtue was, of a verity, the elect of the Lord.

I have dwelt thus at length on the character and official acts of the Cardinal Archbishop of Perugia, in order that the reader might better be able to appreciate his policy and his labors after he had assumed the tiara. The work of Leo XIII. has been, indeed, but a continuation of that which he always had at heart, and which he inaugurated with such signal success while governing his flock in beautiful and historic Umbria. There was nothing sudden or spasmodic about it. It was not something that was conceived only after his accession to

the Papal throne. It was not for him a new or unexpected departure. Far from it! He was simply carrying out on a grander scale the plans which he had formed at the beginning of his brilliant career. He was but following a line of policy which characterized his earliest episcopal acts, and executing, as Pope, what he essayed in a much more circumscribed sphere as the ordinary of Perugia. The pastoral letters of the bishop are but preludes to the allocutions and encyclicals of the Sovereign Pontiff, and the noble document on the "The Church and Civilization" is but the key-note to those epoch-making utterances: "*Æterni Patris*" and "*Rerum Novarum*" and "*Immortale Dei*." The official acts of Perugia's chief pastor are but adumbrations of the brilliant achievements of the immortal Doctor of the Universal Church. As a student, as a bishop, as a cardinal, as Pope, Leo XIII. has throughout his long and eventful life been consistent, and has always been actuated by the same ardent desire and the same unfailing determination to do everything in his power that would in any way contribute to the dissemination of knowledge and the advancement of science.

It would be utterly impossible, within the brief compass of a short chapter, to give an adequate idea of what Leo XIII. has done for the cause of education and general enlightenment. His briefs, letters, allocutions, and encyclicals fill six good-sized volumes. Many of the most important of these docu-

ments bear directly on the furtherance of science and original research, while numerous others discuss the same topics incidentally, but scarcely less effectively. At one time, it is a weighty pronouncement on the study of philosophy or Sacred Scripture, like the "*Æterni Patris*" or the "*Providentissimus Deus*;" at another, it is a letter to a private individual, or to an organized society, like his letter to M. Louis Vivès, encouraging him in his giant undertaking, the publication of the complete works of Albertus Magnus, and his numerous letters to the organizers and directors of the International Catholic Scientific Congress; at another, again, it is a decree authorizing the founding of an astronomical observatory, a faculty of science, or a university; while at still another, it is a document which unlocks to the scholars of the world the treasures of the far-famed Vatican Library, or establishes within its sacred precincts a school of palæography to which all lovers of learning and antiquity may have ready access. His brain is ever active, and his pen is always in his hand. He allows no opportunity to pass, when a word of encouragement from him will help on the cause of education, or advance the interests of science. On one occasion, he addresses simple students and inspires in them a love of study and a desire of achieving success in the higher departments of knowledge. On another, he exhorts the bishops of Hungary, Bavaria, Portugal, the United States, and Brazil to renewed activity in the cause of science, both human

and divine. Nothing eludes his eagle eye. It detects at a glance the wants of the diverse climes and peoples of the world, and he is ever ready with sage counsel and fatherly encouragement to aid the doubting and strengthen the weak.

As Pope, he protests as vigorously as he did as bishop against the oft-repeated calumny, that the Church is opposed to scientific progress and the general spread of enlightenment. Both by word and act he demonstrates the falsity of the charge, and shows that it is not only unsupported by the known facts of history, but that a bar to progress would contravene the best interests of the Church herself. As an apologist in this matter, and defender of his flock, he is without a peer among his contemporaries, and without a superior at any period of the Church's history.

In his memorable encyclical "*Æterni Patris*," in which he urges the study of the philosophy of St. Thomas Aquinas, he points out the necessity of philosophy as a guide in the study of nature, and shows how the natural and philosophical sciences may be of mutual benefit to one another. "The examination of facts," he says, "and the contemplation of nature will not suffice to make their study fruitful, or assure its advancement; but facts being stated, it is necessary to rise higher and to exercise care in recognizing the nature of material things and in ascertaining the laws they obey, as well as the principles which give rise to the order in which they stand to

each other, the unity of their truth, and their mutual affinity in diversity."

Commenting on this encyclical before a large throng of scientific men, who were accorded a special audience, he tells them: "Apply yourselves carefully to the study of nature. But in the study of the sciences do not, as those who wickedly turn new discoveries against the truth of the philosophic, as well as against those of the revealed order, but rather give thanks to Divine Providence, who has reserved for the men of our day the glory and superiority of materially increasing by their industry the patrimony of the useful things bequeathed to them by their ancestors."

True philosopher and true lover of science that he is, Leo XIII. sees that there can be no conflict between science and religion; that the Church, far from having anything to apprehend from the advancement of science, has, on the contrary, much to gain; that, far from being opposed to true scientific progress, she is naturally inclined to further such progress, if for no other reason than that she thus greatly contributes to her own power and usefulness.

"Reason," declares the Pontiff in his encyclical on "Human Liberty," "plainly teaches that verities divinely revealed and natural truths can never be in real conflict with one another; that whatever is at variance with revealed truth is, by that very fact, false. For this reason, therefore, the divine magis-

terium of the Church is so far from impeding scientific research and advancement, or in anywise retarding the progress of enlightenment, that it brings to them rather an abundance of light and the security of its protection."

But while addressing himself to the world in general, he never loses sight of those who, by their calling, should be teachers and leaders. We have seen what a deep interest he always evinced, while bishop, in the education of those who were destined to be the future Levites of his diocese; how he wished them to be learned, not only in sacred, but in profane science as well. As Sovereign Pontiff, this interest in ecclesiastical students intensified, and his desire to see them become proficient in all the higher branches of knowledge is stronger and more ardent. As scholars and thinkers, he wishes the priests of the Church to be in the front rank of the intellectual movement of the time, and he lets no occasion pass without dilating on the supreme importance of culture and erudition among the clergy in this period of scepticism and polemics.

In an encyclical to the bishops of Italy he writes : " Grave are the reasons, and common to every age, that ask many and great adornments of virtues in priests. But this, our age, earnestly demands more and greater. In fact, the defense of the Catholic faith, in which priests ought to labor with special industry, and which in these times is so much more needful, requires no common or average learning,

but a training various and exquisite, which may embrace not only sacred but philosophical studies, and may be well stored in the handling of physical and historical subjects. For the error of men seeking to sap the foundations of Christian wisdom that is to be rooted out is multiplex. And very often the contest is to be with men clever in devices, obstinate in dispute, who have gathered their resources from all kinds of science. . . .

“Labor then, venerable brethen, so far as you can, that the youth who graduate in sacred studies may not only be more instructed in the investigation of nature, but also instructed well in those arts which relate to the investigation by interpretation or authority of the Sacred Writings.”

The same idea is expressed no less unequivocally in a letter addressed to the Bishop of Catania regarding the course of studies to be pursued in the great Benedictine College of St. Anselm, in Rome. Besides the usual ecclesiastical studies in such institutions the illustrious Pontiff desires that special attention be given to the study of philosophy, and of the physical and mathematical sciences. “The character of our age,” avers the Pope, “demands this, because such studies are rendered more than necessary by the movement in their favor, and what is worse, by the prevalence of error now so rampant. Philosophy is necessary to defend the truths of reason and faith; the physical sciences and mathematics are required in order that this domain be

not left entirely in possession of the enemy, who contrives to draw from it a goodly supply of arms with which to attack many truths, both revealed and natural."

In an encyclical, however, addressed to the hierarchy of the United States, His Holiness speaks even more forcibly and eloquently. Indeed, all that he has hitherto written on the subject which is so dear to his heart seems to find a culmination in one paragraph of this noble document. With the precision and fervid earnestness of a St. Augustine and a Bossuet, he affirms that "An education cannot be deemed complete which takes no notice of the modern sciences. It is obvious that in the existing keen competition of talents and widespread, and in itself noble and praiseworthy, passion for knowledge Catholics ought not to be followers, but leaders. It is necessary, therefore, that they should cultivate every refinement of learning and zealously train their minds to the discovery of the truth and the investigation, so far as possible, of the entire domain of nature."

Catholics ought not to be followers, but leaders. This is the dominating, the all-pervading idea of the Pope, who has been characterized, and how appropriately, as *Lumen in Cælo*—Light in Heaven. True to the traditions handed down by his illustrious predecessors; true to the teachings and the lofty aspirations of Clement of Alexandria and Origen, of St. Gregory of Nyssa and St. Augustine, of Albertus Magnus, and the Angel of the Schools, Leo XIII.

desires that the Church should ever be as a city of light on a mountain, to be seen from afar, and that her ministers should, one and all, be torch-bearers not only of the Gospel but of science as well.

But Leo XIII. does more than exhort and advise and encourage. This alone were a great thing, considering the exalted position he occupies, and the powerful influence he wields. He not only recommends, but acts. He is not only a patron of art, science, and literature, but he is the founder of learned societies and famed universities. The universities of Freiburg, Ottawa and Washington owe their existence to him. The school of scientific philosophy at Louvain is his creation. The Catholic universities of Paris, Toulouse and the American College at Rome owe a debt of gratitude to him for favors received. In addition to all this, he founded in the Vatican a school of palæography and inaugurated and equipped what is now justly regarded as one of the best astronomical and meteorological observatories in the world, the great observatory of the Vatican. Nor is this all. According to the universal desire of the scholars, he opened up the secret archives of the Vatican and placed their precious records at the disposition of the world of learning. "Catholic, Protestant, and Jew, men of all nations, may now examine the records of the Papacy for the last six hundred years, the reports of its legates and nuncios, the drafts of the Papal replies and directions, the expenses of the Papal administration, the

secrets of many a knotty problem in the national histories of Europe and the mechanism of the missionary activity of the Roman Church."

When Leo XIII. threw open the secret archives of the Vatican he had in mind solely the cause of truth. He had no fear lest something should be discovered which would reflect unfavorably on the Papacy, or that revelations would be made which would affect the prestige and sully the fair name of the Church. Truth, before every other consideration, was his foremost thought. The Church has been before the world for nineteen centuries, and she has nothing to be ashamed of; neither has she anything to fear or conceal. She wishes to be as an open book which those who run may read. Far from dreading disclosure, she courts investigation, and even challenges it when such a process is designed to subserve the cause of truth and religion.

Not long since, the chief of the corps engaged in preparing certain of the Vatican manuscripts for the press thought it would be better to eliminate from them certain discreditable circumstances connected with the history of the Church. But before acting on this impression he sought instructions from the Pope. The reply of Leo XIII. was characteristic. "Publish everything," he said, "suppress nothing for the sake of policy, even though it may reflect upon the conduct of certain ecclesiastics. If the Gospels were to be written at the present time there would be those who would suggest that the treach-

ery of Judas and the dishonesty of St. Peter should be omitted, in order not to offend tender consciences."

The noble Pontiff's letter to Cardinals De Luca, Pitra, and Hergenroether on "Historical Studies" is another proof, if any were needed, of the truth of these assertions. A short quotation from this splendid document admirably exhibits the mind of the Pope, and indicates, in a few words, what are the duties and rules of the true historian. He says: "Barren narrative should be opposed by laborious and careful research; prudence of judgment should take the place of rashness of views; levity of opinion should yield to a proved knowledge of facts. Every effort should be made by consulting the original documents to unmask forgery and refute falsehood. Historiographers should ever bear in mind that *the first law of history is to dread uttering a falsehood; the next is not to fear stating the truth; lastly, the historian's writings should be open to no suspicion of partiality or animosity.*"

Truly, these are declarations that every historian may ponder with profit. Would that such rules were always followed! How soon would not the entire science of history be transformed and ennobled! In perusing these simple, yet weighty, statements one is forcibly reminded of the advice given to the historian Janssen by Pius IX.: "Never let your love of the Roman Church," said the sainted Pontiff, "allow you in the least to detract from the truth."

Could anything be more disinterested, more beautiful, more sublime?

It is the glory of the Popes that they have ever been the patrons and the promoters of science, art, and literature, as well as the exponents and supporters of religion and morality. History tells of more than a hundred universities whose foundation is due directly or indirectly to the inspiring and stimulating action of the Papacy. Of these, no fewer than sixty-six had their origin before the Reformation, while the others have been founded since. The erudite Innocent III. laid the foundations of the celebrated University of Paris; Clement V. inaugurated that of Orleans; Nicholas IV. that of Montpellier; John XXII. and Eugene IV. that of Angers, whilst scores of other universities, which have so long been the honor and pride of Europe, were called into existence by still other successors of the Fisherman.

But brilliant as is the record of the most famous of his predecessors, Leo XIII. is the peer, if not the superior, of the best of them in the great work he has achieved in the cause of education and science. Gregory the Great, Leo IV., and Louis XII. are specially distinguished for their zeal for the instruction of youth; Leo X. is renowned for having been at the head of the renaissance of art and literature; Silvester II., the learned Gerbert, and Pius II., the accomplished Æneas Sylvius, are celebrated for the variety and extent of their attainments. Leo XIII.

walks in their footsteps and has the same claim to distinction. Like Nicholas V., he has the same affection for men of learning, and is never tired of showing his appreciation of true scholarship. Like Urban VIII., he is known as a poet of high order, and, like Gregory XIII., he will ever be remembered for his invaluable services to the science of astronomy. Pius VII. and Gregory XVI. advanced the cause of art and archæology by their extension of the Vatican Museum; Sixtus V. made the library of the Vatican the wonder of the world. Leo XIII. has enlarged and improved both these magnificent institutions, and made them a hundred-fold more valuable by placing their priceless treasures at the disposal of students and scholars. The world was astonished when it saw Lascaris teaching Greek on the Esquiline, in the shadow of the Palace of Leo. X.; it was no less astonished and gratified when the humble Barnabite Monk, Padre Denza, one of the most eminent of contemporary astronomers, presented himself before the International Congress of Astronomers at Paris as the representative of Leo XIII., and offered, as the director of the Vatican observatory, to take part in the herculean task of preparing a photographic map of the heavens. Voltaire rendered due homage to Benedict XIV. when he pronounced him the most learned man of the eighteenth century; Castelar but forestalled the verdict of history when he declared that Napoleon Bonaparte and Leo XIII. are the two greatest men of the nineteenth.

No, it is not science that Leo XIII. dreads; it is ignorance. It is not truth which he fears; it is superficiality and error. Far from impeding research, or checking progress, or repressing the soarings of genius, he would encourage them and give them wings to essay loftier flights. He knows that to study the works of the Creator is to study the Creator Himself in the manifestations of His power and wisdom and love. He realizes that the reverent cultivation of the physical sciences must of necessity lead to a better understanding of that magnificent poem of creation in which the Divine perfections are exhibited in such passing beauty and splendor. And when these sciences are applied to the practical arts of life, to industry, to agriculture, to engineering, to navigation, to the general welfare of the human family, he is the first one to see that they thereby recount the glory of God, and declare how the hand of Omnipotence has placed the forces and elements of nature at the disposal of His creatures.

Far from seeing in science an enemy of faith, Leo XIII. recognizes in it an invaluable auxiliary. Like the great Origen, he regards it as "a prelude and introduction to Christianity." Like the great author of the Hexapla, he gently chides those timid souls who hold science in suspicion as "children who have a dread of phantoms," and, like this same prodigy of the early Church, he would make "music and mathematics, geometry and grammar"—the whole circle

of the sciences—serve as a rampart for the defence of the Holy City, the precious depository of revealed truth. He remembers that all the great men of science were men of strong religious convictions, as well as men of profound knowledge, and that they found nothing in their studies and discoveries which is irreconcilable with the truths of revelation. Copernicus in the preface to his "*De Orbium Cœlestium Revolutionibus*," Kepler in the fifth book of his "*Harmonice Mundi*," Newton in his "*Principia*," Linnæus in his "*Systema Naturæ*," Euler in his "*Lettres sur quelques Sujets de Physique et Philosophie*," Cuvier in his "*Discours sur les Révolutions de la Surface du Globe*," Barrande in his "*Système Silurien de la Bohême*," Lenormant in his "*Historie Ancienne de l'Orient*," De Rossi in his "*Roma Sotteranea Christiana*," to name but a few of the Agamemnons of science, have demonstrated in the most convincing manner that the teachings of faith and the teachings of nature, far from being antagonistic, are ever in perfect accord, and far from generating confusion in the mind of the true investigator, are seen by him in their proper relations and in their sublime harmony.

No, I repeat it, Leo XIII. does not fear science and the universal diffusion of knowledge, even the highest knowledge of which the human mind is capable. He does not fear progress, and civilization, and culture. Knowledge, progress, culture, religion, morality he loves with an inborn, abiding, overmas-

tering love, and his lifework is the best evidence of how zealously, assiduously, and effectively he has labored in the interests of one and all. He does not, indeed, believe with Renan and his admirers that "science will always furnish man with the only means he has for ameliorating his lot." By no means. But it is not because he loves science less, but because he loves religion and morality more. Far from minimizing the value of science or the necessity of progress, he champions and demands both the one with the other. With the great St. Vincent of Lerins, he says in effect: "Let there be progress, therefore; a widespread and eager progress in every century and epoch, both of individuals and of the general body, of every Christian, of the whole Church; a progress in intelligence, knowledge and wisdom, but always within their natural limits and without sacrifice of the identity of Catholic teaching, feeling and opinion."

These noble sentiments give color and unity to all his official acts; they constitute the burden of his allocutions and encyclicals; they characterize and ennoble his incessant labors in the cause of intellectual and social advancement. Judging him by his life-work, and especially by his love for science, for culture, for truth, and religion, Leo XIII. seems to have chosen as his motto the beautiful and pregnant words of Clement of Alexandria: "Let science be accompanied by faith; let faith be illuminated by science."—πιστὴ τοίνυν ἡ γνῶσις, γνωστὴ δὲ ἡ πίστις.

CHAPTER II.

LEO XIII. AND THE SOCIAL QUESTION.

ONE of the greatest questions of the day, it is admitted by all, is the social question, and its most illustrious exponent is, without doubt, the august Pontiff of the Vatican. Ever since his assumption of the tiara Leo XIII. has manifested a special interest in all problems relating to the welfare of society. This is abundantly evinced by his noble encyclicals on these topics, and by his numberless letters to eminent representatives of church and state.

In a private audience, with which I was favored not long since, the social question was introduced and discussed at some length. I ventured to tell His Holiness that the editor of the *North American Review* had requested me to write an article on this subject, and that the people of America, non-Catholics as well as Catholics, were always pleased to give respectful and reverent attention to his utterances, and especially to all those in anywise bearing on the condition of the laboring classes.

"Ah, yes," he said, "the Americans are a noble people. I love them greatly. I am aware of the deep

interest they take in social problems and was gratified to learn that they received so kindly my encyclical on the condition of labor. You may tell the people of the United States, through the *North American Review*, that I shall always be ready to contribute to the fullest extent of my power toward their well-being and happiness, and especially toward the well-being and happiness of the wage-earners of their great republic.

"The social question," continued the venerable Pontiff, his eyes beaming with light and intelligence as he discoursed on the subject to which he attaches so much importance—"the social question is the great question of the future. *La question sociale, c'est la question de l'avenir.* It is a question in which all should be interested, and each one should contribute his quota toward lessening and removing the difficulties with which it is at present beset. It is particularly desirable that ecclesiastics should be thoroughly conversant with the subject, and that they should take an active part in every discussion and in every movement that looks toward the betterment of the social condition of humanity, and especially the social condition of that major portion which must earn their bread by the sweat of their brow."

This is but a brief synopsis of what the Holy Father actually said, and conveys no idea whatever of the earnestness and impressiveness which characterized the spoken words of the large-hearted and noble-minded occupant of the Chair of Peter. He

dwelt particularly on his encyclicals, "Immortale Dei" and "Rerum Novarum," and referred incidentally to other documents, bearing on the same subject, of which he is the author.

The encyclical "Longinqua Oceani Spatia" is, in a measure, but a supplement of the "Rerum Novarum." I shall consider the two documents, therefore, in so far as they both deal with the social problem, as virtually one and the same.

So much by way of preamble. The following pages are designed to give a brief exposition of the origin, character and history of the social question from a Roman Catholic point of view, and to exhibit the gist of the Pope's teaching, as gathered from his letters and encyclicals on this all-important subject.

I.

A little more than a century ago, in 1791, the French Revolution abolished by a third and definitive decree the corporations which formed the basis of the old social order. In 1891, Leo XIII. promulgated a new economic charter, at the very moment when the industrial association, which was the outgrowth of the Manchester School, was approaching dissolution.

In lieu of the old organic *régime* the French Revolution substituted the reign of individualism. Unlimited competition, freedom of labor, the preponderance of capital and the general introduction of

machinery ushered into existence the fourth estate—proletarians, or wage-earners—and with it the social question. The organism became a mechanism, and from its excesses proceeded the evils from which we now suffer. As matters at present stand, we have two inimical forces, standing face to face; on one side the modern state with its army and its police; on the other, socialism and organized labor with its battalions and its long pent-up grievances.

Never before was humanity confronted with such a danger. It is related that when Antioch was taken by the Persians, A. D. 266, the entire population of the city was assembled in the theater. The seats of this theater were cut in the foot of the escarped mountain which crowned the ramparts. The eyes of all present were fixed on the chief actor; every ear was strained to catch his words, when suddenly his hands began to contract, his arms became paralyzed, and his eyes assumed a startling stare. From the stage on which he stood he beheld the Persians, already masters of the defences of the ill-fated city, rushing down the mountain with resistless impetuosity. At the same moment the enemy's arrows began to shower down within the precincts of the theater, and to awaken its inmates to a realization of their perilous situation.

Is not our situation analagous? Have we not felt the earth tremble under our feet, and heard the social revolution—as Lassalle predicted it would—knock at our doors? And what augments the dan-

ger is that the International seems decided on the policy of delay, until the natural pressure of our social conditions shall place the reins of power in the hands of the "new masters." 1848 and 1870 appear to have been the last attempts of the Fourth Estate to achieve victory by force of arms. Its leaders are unwilling to commit new blunders, and are persuaded that the day will come when socialism will be triumphant.

Leo XIII. chose this prophetic hour to make known the social evangel to the combatants on both sides. Among the wrecks of human institutions, the Papacy remains the sole international power, sufficiently equipped, sufficiently sure of its own resources, sufficiently endowed with light and energy, to attempt the supreme work. It, alone, has imperturbable faith in the future of humanity. It is idealist, in spite of all deceptions; optimist, notwithstanding all the spasmodic weaknesses of the body politic. As in the politico-religious order, Leo XIII. has, through his encyclical, "*Immortale Dei*," preached the code of reconciliation, so has he, in the economic order, promulgated the charter of social harmony. We recognize in the earnest, but tender words of the Pontiff, the divine perfume of the Master, precise lessons of the Fathers of the Church, and the carefully pondered and the soundly democratic teachings of the Doctors of the Middle Ages. For the first time, economic science has pity on the wage-earner, and discusses the new issues raised without rancor

or recrimination. At the same time it exhibits a respect for the rights of all while insisting on the duties of all, which will forever render the encyclical, "*Rerum Novarum*," not only the most glorious monument of the present pontificate, but also the most beneficent contribution yet made to the new order of things. In the Church alone is there a condition of stable equilibrium, which always remains unaffected. The personal character of the encyclical resides, not so much in the lessons of justice and charity as in the perfect adaptation of revealed truth to our present condition, and in the beautiful and fruitful manner in which the facts of history are harmonized with eternal principles.

Leo XIII. is at the same time as compassionate as a mother, and as impassable as an anatomist; as just as a judge and as tender as an infant. He loves ardently that poor humanity which is so often blind to its best interests, but which is more frequently betrayed by its own leaders. In him the Papacy appears even to-day, as the empyrean in which all hatreds and struggles are buried and in which all great reconciliations are effected. Indeed the most distinguishing characteristic of the encyclical is that it seeks to harmonize capital and labor, to reconcile employer with employee, to unite justice and charity.

The first part of the encyclical shows that the accord between labor and capital is one of the most beautiful and most consoling laws of political econ-

omy. As God, in the book of Job, "makes peace in the high places," so does Leo XIII., from the lofty eminence which he occupies, bring to men the peace-giving breath of the Infinite.

This equilibrium has its origin in the Pope's comprehensive genius. Leo XIII. knows not that exclusivism which divides the social order into separate compartments. His breadth of view and love of humanity preclude this. His keen intellect has grappled firmly with all the difficulties of the situation. Economists too often separate what should ever be united. One expects everything from the state, another looks for a cure only from above, while still others appeal for a solution of the problem to special associations or to private initiative. But Leo XIII. embraces all these factors, and causes every one of them to make for the common weal. The Church, the State, the individual activities, society as a whole, should not they be prodigal of their best efforts in helping forward the work of reconciliation?

It is this harmony and breadth of view which give to the encyclical the character of arbitrament which it possesses, and make it, as it were, a kind of truce of God. Hence springs the facility with which the Pontiff steers clear of the quicksands of this vast world. And with what dangers is he not beset? Intrinsic difficulties, technical difficulties, complexity of subject, a continual transformation of political economy, which scarcely permits one to promulgate

doctrines and principles, antagonistic passions and rivalries—Leo XIII. has met all these obstacles.

Thanks to his marvelous competence and his profound knowledge of the subject-matter of debate; his consummate art in separating theories from facts, and principles from remedies, Leo XIII. has avoided these reefs. He is at the same time a doctor and a practical man of affairs; an illuminator and a conciliator; resting here on the gospel and St. Thomas Aquinas, and there seeking aid in the immense modern laboratory, where are found both men and hypotheses.

Such are the distinguishing notes of the encyclical; its opportuneness, its evangelical character, its irenical harmony, its perfect comprehensiveness. These are combined with scientific precision and an incomparable simplicity of art, in which supreme elegance and exact science unite in sweetest symphony.

II.

What, it may be asked, has occurred in society, that special exertion is now required to keep in motion a machine which formerly moved of itself without noise and without effort? In what does this much-talked-of social question consist? All are making the same inquiry, but the responses given are as diverse as the prescriptions of physicians. More than ever before, the world is brought to face seriously the social question. Formerly,

certain minor social questions perturbed humanity, but the crisis which now confronts us is peculiar to our own epoch.

It is only the foolish hope of interested optimists which will lead men to believe that they are sheltered from the impending catastrophe, because, forsooth, the same endemic malady has before raged in all countries and at all times. It is, indeed, true that social antagonism is not something new or something peculiar to our century. But there is between the past and the present this essential difference. Formerly, after the struggle between employer and employee was over, rest and peace were to be found in the workshop or in the home, whereas to-day the struggle has reached our very hearthstones. It persists in a dull and sullen manner, when it does not break forth openly, and it is ever compassing the ruin of society because it is incessantly destroying all chances of domestic happiness. Never before, indeed, has the social question knocked in so threatening a manner at the doors of the civil order.

In the introduction to his epoch-making document, Leo XIII. directs attention to some of the evidences of the dominant evil—extreme riches, extreme misery, and the indescribable desolation which has entered the world of the proletariat in consequence of the atomization of society under the levelling reign of capital.

Gifted with a methodical mind and endowed with

a rare genius for classification, the Pope limits himself to indicating the roots of the evil, without entering into details, or descending to investigations of secondary importance.

It may truly be said that the social question arises from a fivefold revolution: the revolution in machinery; the revolution in political economy; the revolution in religion; the revolution in the state, and the revolution brought about by the general movement of humanity.

Machinery, or rather the abuse of machinery, was the first to effect a transformation in the economic order. It is not without reason that Lassalle styles it "the revolution incarnate"—*Die verkörperte Revolution*. Machinery has revolutionized the mode of production, the manner of labor, and the distribution of revenue and of property. It has destroyed the workshop and introduced the factory in its stead. It has sterilized manual labor and, by its immense productivity, has internationalized prices and markets. While, on the one hand it has created the despotism of capital, it has, on the other, called into existence the unorganized army of the proletariat. It has ground humanity into a powder without cohesion and without unity, and has placed the world of labor at the mercy of a few soulless plutocrats. This new order of things means the reign of the few; it implies the permanence of expropriation and the resurrection of ancient Rome, where millions of slaves were trampled under foot by an insolent

oligarchy of wealth. And, finally, by its fatal centralization, machinery has engendered a double International—the International of capital and the International of socialism.

Against such a condition of things there should have been erected some sort of protecting dike. But instead of creating a new order, in conformity with the changed mode of production, economic science introduced into the laws and institutions of the land those very principles which have rendered the influence of machinery sinister and destructive. Of an agency marvellously rich in its potentialities, it has made an engine of revolution. Production, production, nothing but production, such has been the ideal, the last word of the Third Estate and of economists. Adam Smith in England, J. B. Say in France, and Schulze-Delitsch in Germany, have traced out this new legislation, with a view to bringing out of machinery all its latent force, without ever thinking of the terrible confusion that was sure to ensue.

Science and politics have leagued together to render the state omnipotent. How then could socialism regard with serenity a factor of such unquestioned power?

Absolute collectivism was born and received with acclamation in the *comitia* of the people before it was scientifically promulgated by Carl Marx. The sons of toil constitute the majority. Why are they not then the rulers?

Riehl, before Sainte-Beuve, had drawn the portrait of the literary proletarian as the guide of the laboring proletarian. *Declassé* and a conspirator, ambitious, jealous and vindictive, he finds a use for his knowledge in giving his services to the advancement of revolutionary socialism. A German, Riehl spoke for the Germans. But have not his prognostications been everywhere verified? You have supplied outcasts and the declassed with all modern arms—education, universal suffrage, literature. You have awakened them to a consciousness of their power. You have taught them that law is the voice of the majority, that education is the stepping-stone by which they may attain to power. You have endowed them with sovereignty. You have made them legislators and judges. Why, then, should not the masses rise up and announce to the Third Estate: We are the masters?

Politics and their historical environment created Lassalle and Carl Marx. Lassalle and Carl Marx created militant socialism and the International.

“Liberalism,” says Averbeck, “has acted as a state would act if it should banish a part of its citizens to a solitary island and let them there begin a struggle for existence. This state gives to the exiles all the treasures of science, libraries and scientific apparatus, but it withholds from them what is necessary for subsistence. It is to be presumed that such unfortunates will burn the books in order to warm themselves, and break the instruments in order to

make tools that will enable them to gain the necessities of life." The same writer was likewise one of the first to signalize the perils of this political and social contrast. To-day the situation seems even more grave. For, has not the International the same engines of war as the state? Has it not at hand all the appliances requisite to start a revolution? The stupefied Liberals persist in persecuting the Church, in weakening the ethical sense, and dancing on a volcano until everything shall be blown to atoms.

Do we not read the signs of the times? One would declare that everything conspires to crown the Fourth Estate. As far back as 1810 there were not wanting far-seeing synthetic minds who foresaw that the reign of social democracy would issue in the natural and fatal termination of civilization. Philosophers and critics have expended an infinite amount of wit in their attempts to give a definition of civilization, but no two have been able to agree on the same definition. The events of our day, however, make a definition unnecessary, for we have before our very eyes the most salient facts of all history, past and present. For what is the evolution of humanity but its expansion and progressive exaltation?

All the theories of philosophers and all the preachments of exploiters are of no avail. We are moving toward a triumphant democracy. Whether the transformation of the aristocratic and *bourgeois*

society into a democratic society be slow or prompt, violent or peaceful, it is none the less inevitable; and, more than this, none the less irrevocable, once it shall have been effected.

There are several reasons in explanation of the difficulty of a return. All men are not sensible of the exalted charm of liberty, and freedom is not an imperative need for a large number of men. But the sweetness of equality appeals strongly to the most feeble intelligences, and men are slow to renounce this pleasure when they have once tasted it. Besides this, the laws and customs of a democratic society are in accord with certain ideas of right and justice, and they find in the conscience as well as in the passions of men a powerful support.

What intensity marks this movement! What a formidable support for the Fourth Estate! And how singular the coincidence of this general current with the present economic crisis. Sieyès wrote: "What is the Third Estate? Nothing. What ought it to be? Everything." Is it astonishing that the chiefs of the International apply these words to the Fourth Estate.

We have briefly considered the five confluents which constitute the river of the social question. Never has a more complicated situation, or one more pregnant with peril, weighed upon men. What were the invasions of the barbarians from the north of Europe, or the upheavals of the fifteenth and eighteenth centuries, in comparison with the threatened

explosion of this vast world already stirred to its profoundest depths and in a state of violent ebullition?

Has not the time at length come when some one should speak in the name of all, and above all; when some one should take up the problem, not with the pedantry of party, nor with affected scholastic display, but with a keen and serene intellect which is competent to get at the heart of things without becoming entangled, and is capable of taking a comprehensive survey of the situation without getting confused? Is there not required one of those rare men with whom conscience in everything is a prime necessity, and whose greatest pleasure and recompense lie in the laborious pursuit of good and in the absolute discharge of duty?

Such an one is Leo XIII. With that buoyant and indomitable spirit which has never known weakness, of which age has respected the integrity, Leo XIII., after having disentangled, analyzed, and scrutinized all the elements of debate, has judged it necessary, not only as a man of science, but also as supreme teacher, to undertake the great work of synthesis and truth.

III.

Since issuing his famous encyclical, "*Rerum Novarum*," of which Europe, poisoned by the School of Manchester and by the teachings of a materialistic philosophy, had greater need than young and pros-

perous America, Leo XIII. has developed his apostolic doctrine more in detail. This is observed especially in his letters to the Count de Mun, the Bishop of Grenoble, the Bishop of Liège, the Cardinal of Mechlin, as well as in his letters to M. Decurtins, to Abbé Six, to Abbé Naudet, and others. All these manifestations of the great Papal mind are bound together by the same golden thread. Go to the people to assist and emancipate them. Establish syndicates and associations for the laboring classes. Demand from the state legislation for their protection, and strive to secure the passage of a law, international in character, which shall protect at the same time both employer and employee from economic piracy. Restrict the hours of labor, and place women and children under proper protection. Give to the poor man a just remuneration for his work, and strive to make him an upright and honorable citizen. Above all, see that religion is the inspiring and directing soul of the home, for without it the work of reconstruction and regeneration is impossible.

That which, above all else, brings out in bold relief the solicitude of Leo XIII. for the laboring man is the injunction which he lays on, the mission which he commits to, the priests of the Church. He wishes them to go forth into the market-place, to visit the factories, to found societies for workingmen, to inaugurate conferences for them, and thus to direct the large democratic and social current

which is the result of long ages of effort, labor and sacrifice. To Americans, with their native activity and independence, this is easy and natural. It, however, demanded evangelical courage to impose this on the Old World, where three centuries of renaissance of pagan law, and a century of *laissez-faire* and *laissez-passer* have atomized society and divided the human family into two opposing camps, on one side the tyranny of the law and of the employer; on the other, renewed servitude and virtual rebellion—everywhere hatred, lack of equilibrium, egotism and overt struggle.

One of the most striking characteristics of the Pope's teaching anent the labor problem is his return to the ideas of evangelical solidarity, to the lessons of social wisdom, and to the principles which governed the guilds of the Middle Ages, all of which, with singular skill, he adapts to the needs and conditions of the century just closing. Sometimes reactionaries, and even English Liberals, reproach the Pope with going too far and with favoring methods which are regarded as revolutionary. In the eyes of such people he is a socialist. This revolutionist, however, but relights the almost extinguished torch of Christian traditions. He is simply continuing the spirit of the early ages of the Church. "The day when there shall be placed in the Chair of St. Peter," wrote de Vogué in his *Spectacles Contemporains*, "a Pope animated with the sentiments of Cardinal Gibbons and Cardinal Man-

ning, the Church will stand forth before the world as the most formidable power it has ever known." So be it. Is not Leo XIII. such a Pontiff? Fearlessly brushing aside three centuries of cabinet diplomacy, he declares his intention of following the traditions of those illustrious Pontiffs who are honored in history as social law-givers and emancipators of the people. He synthesizes admirably the Gospel, St. John Chrysostom, St. Thomas Aquinas, Gregory VII., Alexander IV., Pius IV., and many others besides. "The danger is imminent," wrote Madam Adam in her *Patrie Bourgeoise*, "for Leo XIII. is preparing a crusade which a younger Pope may render triumphant. The constitution of the Church and individual devotedness, which Christianity, we must admit, is capable of exalting, in a far higher degree than the philosophy of Paul Bert, are calculated to provoke one of those grand movements of moral reform which are always based on a social movement." Madam Adam forgets that it is not a crusade, but a return to the principles of economic and organic mutuality which obtained before the Renaissance, and an adaptation of them to the age in which we live. This is what Leo XIII. told Castelar, the Spanish Republican, in so many words. "It is necessary," said he, "to bring back the Church to its original traditions." In this declaration are revealed at once the historic mind and the originality of Leo XIII. In it are disclosed his greatness

and the unity and majestic co-ordination of all his acts and all his teachings.

Economically and socially, the Renaissance, the resurrection of pagan law, the cult of exaggerated individualism, the philosophy which issued in Darwinism, have again brought back and made general both the pride and the slavery of ancient Rome. Absolute and pagan theories regarding property, exaltation of liberty, which, while it is the honor of the human mind in the domain of politics, is folly in the domain of economic science, substitution of an artificial mechanism for the normal organism, rupture with industrial organizations, and the atomization of society, in a word, all the miseries of our modern world have proceeded from these sources. Our age is, indeed, but a walled-in field of battle, in which egotism, individual interests and passions are engaged in homicidal combat. Formerly society was an edifice, in which each social floor had its protection, its rights, its security, its well-being. It was, to employ another figure, a vast organism, in which each member, while it was subject to the law governing the whole, had its proper functions and its full life.

It is this thought, eminently Christian and eminently evangelic, a thought reposing on justice and love, which is the mainspring of the social action of the Holy Father. Here, as elsewhere, Leo XIII., while always having a regard for the times in which

we live, supplies us with the traditional means of subsistence and defence. A man of the past and of the future, continuing in his own beneficent way the policy of his illustrious predecessors, while at the same time paving the way for a better to-morrow, without change of principles, but by the application of new methods, the present Pontiff stands conspicuous in history as an innovator, while he is all the while but a priest of the antique ideal, but an ideal appropriated for our own time.

Besides the teachings of antiquity there are other guides nearer to us for pontifical initiative. A conservative power, the Papacy scarcely ever moves in advance of the political and social exigencies of an epoch. It does not create, it codifies.

The Fathers have determined with precision this law of organic growth. Origen, Tertullian, St. Cyprian, St. Augustine, and, above all, St. Vincent of Lerins, have developed the philosophy of this phenomenon. It is thus that they speak of a *sensus theologicus*, of an *intelligentia ecclesiastica*, of a *sensus Catholicus*, which are affirmed, expanded, and translated in a body of doctrines, in *eodem sensu et in eodem dogmate*.

In a lower degree, the Papacy appropriates and condenses the human teachings of each epoch in so far as they bear on the immutable principles of the evangelical and traditional deposit. In every direction in which the energies of the Church are employed, we remark a formal evolution of this institu-

tion which is in relation to the evolution of the ideas and the facts of the contemporary world. With the plastic power, which is *par excellence* the sign of her vitality, the Church adapts herself in our days to the service of societies formed outside of herself, and often opposed to her, as she adapted herself to the feudal system, to the Renaissance, and to all the metamorphoses of her flock. Her work, sometimes, eludes the careless observer, because it goes on by processes which resemble the mysterious processes of growth and development in the higher organisms. Under the action of vital force all the atoms of our body are continually being changed and renewed, but our form and personality are in nowise modified thereby. It is in this sense that we must understand the renovation of the Church and the Papacy.

The Church and the Papacy are never in a hurry. In everything which does not concern eternity, in the domain of the contingent and the relative, her rôle is not to anticipate, but to regulate and to consecrate all the progress definitely made. Some thinkers urge, as an objection and as examples of unexplainable variation, the misfortunes of certain bold spirits, who, in the past, were blamed for having maintained political and social doctrines which were subsequently cordially received by the Vatican. These innovators had started too soon. Political truths, essentially relative, do not become complete verities and acceptable to Rome save at the moment when they appear practical, or when the circum-

stances of time and place clearly evince that the fruit is ripe and may be gathered. In all that concerns herself, the Church is the sole judge of this moment.

The encyclical on the condition of labor and other similar acts of Pope Leo XIII. are the official and permanent consecration of the labors and the teachings of the most devoted Catholics of this century in respect of the social question.

The first one after Ozanam, and the Viscount de Melun, to make a deep impressiou on Rome in this matter was Bishop Ketteler, of Mayence. It was in 1848, when socialism appropriated all the new economic currents, that he promulgated his social evangel. His sermons, preached in the Church of St. Paul, at Frankfort, at the time of the celebrated diet; his conferences with workingmen; his book on "Christianity and Labor"; his discourses at Mayence; all his acts as bishop and statesman had this ideal: Save, emancipate, the Fourth Estate by the application of the Gospel and the doctrines of St. Thomas to the economic conditions of the day.

A man of dauntless courage, comprehensive mind, and noble heart, he was at the same time a Catholic Lassalle. At one time, even, Bismarck seriously thought of making him Archbishop of Cologne, and of undertaking with him the great work of social reconstruction. The *Kulturkampf*, which the Iron Chancellor inaugurated in order to placate the national liberals, to break the power of Rome

and to divide France, rendered this grandiose project illusory. Ketteler, however, did not abandon his plans. While the storms raged above the German forests he gathered about him those gallant heroes: Vogelsang, Kuefstein, Scheicher, Hitze, Joerge, Monfang, Schorlemer, Brandts, Bachem, and all that chosen band, who, even in our own day, with less *élan* and more timidity, it is true, continue to develop his ideas. At the Council of the Vatican, before the cannon of Sedan had startled Europe, the Bishop of Mayence hoped to secure official recognition of his programme, and thus to bring the laboring world within the orbit of the Church. But this fondly cherished hope was not realized. "And to think," he complained to the Archbishop of Rouen, "to think that we have not been able to utter that cry of love and sympathy to the outcasts of the century."

But the seed which he sowed germinated. On the morrow of this same war, a representative of France took up the idea which had its birth beyond the Rhine. Supported by the teachings of Leplay and Perin, the Count de Mun, with the volcanic fire of his eloquence, continued the social crusade. He soon succeeded in rallying around himself such soldiers as La Tour du Pin, P. Pascal, M. Lorin, Abbé Naudet, Abbé Bataille, Abbé Six, M. Sabatier, and, above all, Cardinal Langénieux and M. Leon Harmel, who led to the Pope the first workingmen's pilgrimage.

At this same epoch, the Abbé Pottier, professor at Liège, in Belgium, discovered his vocation for social work. A priest and a theologian, he had a singular love for the poor, and was possessed of a judgment that was almost infallible. From the Gospel he drew forth a whole body of social doctrine, and found a sanction for his apostolate in the highest founts of Christianity. His programme is an irrefutable, economic codification of the doctrines of the Holy Fathers and of the Doctors of the Middle Ages. In spite of all the attacks which have been directed against it, it remains impregnable. Around him also have gathered a zealous body of co-workers like the Kurths, the Levies, the De Harles, the Vetragens, and hosts of others.

Then, again, there is M. Decurtins, a layman. A born democrat, and a counsellor of the nation, he is as ardent an ultramontane as he is an imperturbable socialist. A leader of the laboring classes and a man of broad culture, erudite, eloquent, and energetic, he is endowed with not only an incomparable capacity for work, but also with an incomparable power of will.

He it was who effected in Switzerland the fusion of the labor organizations, Catholic and Protestant. He it was who induced his government to convoke an assembly of all the Estates in order to consider universal social legislation, a project which was frustrated by William II. It is he, too, who makes

periodical pilgrimages to the Vatican to engage the Holy Father to direct the social movement of our time. He has many rivals and imitators, but the noblest spirits of Helvetia are with him.

Such, in brief, is the Latino-Germanic genesis, if I may so express myself, of the encyclical.

The Anglo-Saxon race furnished the Pope with reason for action. Here appear Manning, Gibbons, Ireland and Keane, the last three of whom are almost as well known, and as fully appreciated, in Europe as in their own country. They are men of ardor and action, always optimists, ever alert and never discouraged. Both by vocation and environment they are leaders. Disentangled from the conventionalities of the Old World, they are more free than their European *confrères*; their faith is more pronounced and their word has the true ring of the Gospel of Christ.

As an American, I am proud that the sacred spark which set Europe and the Vatican aflame was applied by our own favored land. In 1887, when the memorial concerning the Knights of Labor was forwarded to Rome, the Christian world still hesitated. But this document was the trumpet note which settled the issue. Rome spoke, the encyclical "*Rerum Novarum*" was promulgated, and timid, Catholic Europe breathed a sigh of relief.

Such, then, are the origin, the character, and the history of the social idea of Rome. Leo XIII. has

been the grand resultant of a historical movement. It is because he was obedient to the laws of history, and because he understood the social needs of his time, that he deserves to be known forever as the Pope of the workingman and the great high-priest of our century.

CHAPTER III.

THE VATICAN OBSERVATORY.¹

FROM the earliest Christian times the Popes and the most eminent representatives of the Church have ever evinced a peculiar love for the science of astronomy and exhibited a lively interest in its cultivation and advancement. All have found in the study of the heavens something noble and elevating, that was not afforded in the same degree by any of the other sciences, and have drawn from it some of the most beautiful illustrations and arguments to be found in the whole range of natural theology. Among the scholars of the early and mediæval Church who were specially noted for their predilection for the science of the stars, it will suffice to mention the names of Origen, St. Gregory of Nyssa, St. Augustine, Dionysius, Gerbert, afterward Sylvester II., Albertus Magnus, Roger Bacon, and Venerable Bede. In later times we have such distinguished names as Copernicus, Regiomontanus, Cardinal de Cusa, Clavius, Scheiner, Gregory XIII., Piazzzi, De Vico, and Secchi.

¹This article, it is important to observe, was written in January, 1895.

It was not, however, merely because astronomy was a fascinating and stimulating science that it was studied with such ardor by saints and doctors, and fostered as it was by the most illustrious of the Church's Pontiffs. For, aside from the inspiration afforded by the contemplation of the wonders of the starry vault, there were also practical considerations which moved the authorities of the Church to encourage the study of the heavenly bodies. Chief among these were the demands of chronology and the necessity of accurately regulating the various festivals of the ecclesiastical year. As far back as the time of St. Polycarp, in the second century, there was a dispute as to the time when Easter should be celebrated. The question was taken up by Pope Leo the Great, and later on by Nicholas V., Sixtus IV., and Leo X., but without any satisfactory results. Not until 1582 was the controversy settled, when Gregory XIII. promulgated the reformed calendar, and made it obligatory throughout the Catholic world.

The building in which the work of the reformation of the calendar was executed forms a portion of the immense pile of buildings in Rome known as the Vatican. The upper portion of the structure, in honor of its projector, Gregory XIII., is called the Gregorian Tower. Connected with the Vatican Library, and, indeed, forming part of this wing of the Papal palace, it rises considerably above the adjacent portion of the edifice. It is a large and massive

structure, containing more than a score of spacious apartments, and is in every way well adapted for the purposes of astronomical work.

The room in which the calendar was reformed is preserved in essentially the same condition in which it existed in the time of Gregory XIII. It is remarkable, not only for its size—it is the largest apartment in the observatory—but also for the beautiful frescoes which adorn the walls and ceiling. These, although several centuries old, are still in an excellent state of preservation, and are fully in keeping with the other admirable works of art which constitute so conspicuous a feature of the magnificent palace of the Vatican.

In the floor, in the center of the chamber, is a large slab of marble in which is executed the celebrated meridian of the noted Dominican, Padre Ignazio Danti, one of the commission appointed for the reformation of the calendar. By means of this meridian and a small aperture in the wall, through which a solar beam was permitted to enter, the learned religious was able to demonstrate the necessity of reforming the calendar, and to exhibit, also, the exactness of the system proposed by one of his associates, Luigi Lilius, of Calabria. The calendar room, as it is called, is now used for the weekly meetings of the Vatican Astronomical Association, a society composed of the staff of the observatory, together with a number of other savants interested in the advancement of astronomy, meteorology, and terrestrial mag-

netism. These reunions are usually presided over by His Eminence, Cardinal Mocenni, assistant Secretary of State, who is the Pope's ordinary representative in the general management of the observatory.

After the completion and promulgation of the Gregorian calendar, the Vatican Observatory underwent various and numerous vicissitudes. The work, which had been commenced so auspiciously, and from which so much was expected, was gradually discontinued, and finally all regular observations were abandoned. The instruments were neglected and dispersed, and eventually little was left but the building itself. Many efforts were made at divers times, especially during the pontificates of Pius VI. and Pius VII., to restore the Observatory to its pristine condition and to equip it with the best instruments of the day, but even the most earnest of such efforts were attended with only partial success.

It was reserved for the illustrious Pontiff now reigning, the immortal Leo XIII., to bring to a successful issue what had been before so frequently attempted, but without serious or lasting results. On the occasion of the memorable Vatican exposition, held in 1888 in honor of the fiftieth anniversary of Leo XIII.'s elevation to the priesthood, the idea of reorganizing the Observatory took a definite and practical form. Among the countless presents which His Holiness received at the time, were numerous and valuable scientific apparatuses, especially in instruments of precision designed for

researches in astronomy, meteorology and geodynamics. When the question came up as to what disposition should be made of these instruments, the enlightened Pontiff at once decided that they should be transferred to the Gregorian Observatory and that the building should immediately be renovated and enlarged, as might be deemed necessary. Work was accordingly begun without delay, and in a short time the building was not only finished, but the instruments were also in place, and everything was in readiness for systematic and continuous observations according to the latest and most approved methods.

That the observatory might not again be exposed to the vicissitudes which had marked its previous history, the Holy Father endowed it with a sum ample to meet all current expenses. But he did more than this. In order that it might be on a par with the best equipped observatories in other parts of the world, and in order that the scope of its work might be as extended as that of the best of those of Europe and America, he decreed that certain portions of the Vatican palace and gardens should also be set aside for the special use and behoof of the observatory. Near the Gregorian tower he gave a suite of rooms for the reception of a large heliograph with its necessary appurtenances. This instrument, used for photographing the sun, is a large and beautiful piece of apparatus, and is an exact duplicate of the one employed by the celebrated

Janssen in his observatory at Meudon. Besides the rooms reserved in the Gregorian tower for meteorological observations, place for such observations was likewise provided at a lower level in the Vatican gardens.

But by far the most important addition to the previously existing observatory was the famous Leonine Tower on the summit of the Vatican Hill. This tower, which was constructed in 848 by Leo IV., as a fortress against the inroads of the Saracens, is admirably adapted for the purposes of an observatory, and in the estimation of such experts as Otto Struve and Rear-Admiral Mouchez, the distinguished directors of the observatories of Pulkowa and Paris, leaves nothing to be desired, either as to freedom from vibration or perfection of horizon.

As to solidity, this venerable tower is comparable with the pyramids of Cheops and Chefren. Its internal diameter is nearly sixty feet, while the walls at the base are no less than fifteen feet in thickness. There are three stories, two of which are arched over with heavy masonry, while the third supports a large revolving cupola of the latest design and best construction. This structure is about a quarter of a mile distant from the Gregorian Tower, and offers one of the most beautiful and commanding views to be had anywhere in the Eternal City. It is, indeed, from this point that one sees St. Peter's as it was conceived by Michael Angelo, and as the great architect desired it to appear from all sides. Owing to a change in

the plan of the building of St. Peter's, which never had Michael Angelo's approval, the magnificent dome of the great basilica is not seen to advantage from the front, as the designer wished it to be, and hence, one must view it from the rear to have an accurate idea of the grandeur and unity of design of this noblest of the world's temples.

The two lower stories of the Leonine Tower are set apart for researches in terrestrial magnetism and seismology. In the upper story is placed a large photographic equatorial, in size and design exactly like the great instrument in the National Observatory of Paris. The chamber in which the equatorial is placed is provided with clocks, barometers, etc., while in adjoining rooms are all the appliances requisite for exact and systematic work in celestial photography.

Just now the astronomers of the Vatican Observatory are busily engaged in executing their part of the colossal international chart and catalogue of the heavens. As is well known, the astronomers of the world resolved some years ago, in 1887, to make a photographic map of the entire surface of the stellar sphere. This stupendous work, involving the taking of more than forty thousand photographs, was apportioned among eighteen of the chief observatories of the northern and southern hemispheres. To each observatory was assigned a certain zone of the heavens, the zone which, considering the latitude of the observatory, could be photographed

with the greatest convenience and with the best results. The zone assigned to the Vatican Observatory embraced that portion of the heavens confined between fifty-five degrees and sixty-four degrees north declination.

Each observatory will take two series of photographs, one series for the chart of the heavens, the other for a new catalogue of the stars. The number of photographs to be made by each observatory depends on its location. The observatories in the southern hemisphere, on account of the comparatively limited number of stations, will have more to do than those north of the equator. Thus, while the astronomers of Catania and Helsingfors will be required to take but 1,008 photographs each, those of the Cape of Good Hope will be obliged to make no fewer than 1,512. The number to be taken by the Vatican Observatory amounts to 1,040. Of these more than four hundred are now [January, 1895] ready, all of which have been pronounced by the Central Committee of Paris to be of the highest order of excellence.

It is estimated that it will take about two years more for the Vatican astronomers to complete the task assigned. As may be readily imagined, the work proceeds slowly. It is something that demands the attention of experts, and, aside from being very fatiguing, it requires constant and careful attention. The time of exposure of the plates to be used in the preparation of the new catalogue of stars

need not to be more than a few minutes, ordinarily five or six, as it is not the intention to take cognizance of stars which are less than those of the eleventh magnitude. In the chart, however, much smaller stars will appear, as it has been decided that it shall exhibit those even which are only of the fourteenth magnitude. The exposure for such faint objects varies from one to two hours, depending on the condition of the atmosphere and on other circumstances which need not here be indicated.

So delicate and so powerful are the apparatuses employed that it has been found practicable to photograph stars of even the sixteenth or the seventeenth magnitude, and it is thought that it would be possible, under favorable conditions, to catch on the sensitized plate stars that are only of the eighteenth or the nineteenth magnitude, objects which are invisible to the eye, even with the aid of the most powerful telescope yet constructed..

Some of the photographs of stars and nebulae which have been taken in the Leonine Observatory required an exposure of no less than nine hours. During all this time the operator was obliged to keep in a reclining posture, with his eye always at the ocular, and his hand on the rods designed for moving the telescope in right ascension and declination. The instrument is, of course, turned by powerful clock-work, but accurate as this is, it is found necessary to adjust by hand the slight irreg-

ularities of motion which are inevitable even in the most perfect equatorials.

The photographs for the catalogue and chart of the heavens are taken on specially prepared plates of sixteen centimeters, about six inches square. In order that the position of any given star may be determined with readiness and exactness, each photograph is crossed by a number of fine lines at right angles to one another. And for the purpose of locating rapidly and accurately the position of the countless stars in the catalogue, the brothers Henry, of the Paris Observatory, have devised an ingenious instrument, known as the *macromicrometer*. One of these valuable apparatuses is in the Vatican Observatory, and is an object of special interest to all visitors, especially to astronomers.

When the photographic catalogue of the stars shall be completed, it will be as far superior to the catalogues of Piazzi, De Lalande, and Argelander as is Rowland's solar spectrum to maps of the sun's spectrum prepared by Fraunhofer, Kirchhoff, and Angström. The old catalogues fixed the places of some tens of thousands of stars. The new one, now being made, will indicate the position of many tens of millions, and so accurately, that future observers will have no difficulty in determining the direction and amount of any one of the heavenly bodies which may have been photographed.

But, although the principal work of the Leonine Observatory at the present is the taking of photo-

graphs for the mammoth catalogue and chart which is in course of preparation, it is not the only work. Photographs of the other heavenly bodies, of the moon, the planets, of comets, and nebulae, are also being made. Some of these, indeed, are such splendid specimens of work that they have elicited the unqualified admiration of all who have seen them. Considerable attention is also given to the photographing of stellar spectra, and it is the intention of the astronomers in charge to make this a prominent feature of their work as soon as they shall have more time at their disposal than they now have. An interesting series of cloud photographs has likewise been secured. By meteorologists such photographs are considered as possessing special value, and those taken at the Vatican Observatory are pronounced by competent judges to be of superior merit.

In the Gregorian Tower is carried on all the work usually done in an astronomical observatory. It is singularly well equipped with instruments of investigation of all kinds. It is especially well provided with the latest patterns of automatic instruments, particularly in the apartments devoted to meteorology. The library is already quite large, and is rapidly increasing in size and importance. It receives the public reports of more than three hundred observatories in all parts of the Old and New World, and in exchange for them it sends out to its correspondents its own publications, which are noble illus-

trations of unvarying accuracy and conscientious labor.

Leo XIII., as founder of the Vatican Observatory, has always manifested the liveliest interest in the work which is there being accomplished, and is ever ready to do anything in his power which may subserve its interests or conduce toward its betterment. I shall never forget the enthusiasm with which he spoke of his *Specola*, the Italian word for Observatory, on the occasion of an audience which I recently had with His Holiness, nor the profound interest which he exhibited in the general advance of astronomical science. He is thoroughly informed as to what is being done by his observatory, and is proud that the *Specola Vaticana* was one of the first to offer to take part in the great international undertaking of photographing the heavens.

When I spoke to His Holiness of my intention to write an article on the Observatory for the *Cosmopolitan*, in order that the people of America might know what he had done for the advancement of the science of astronomy, he seemed specially pleased. "*Va bene*—good," he said; "I trust you will find it to compare favorably with the other observatories." I replied, that having visited the chief observatories of Europe and America I was familiar with their equipment, and that I was much gratified to find that the observatory of the Vatican could bear comparison with the best of them. "I am glad to hear you say this," resumed the venerable Pontiff, "for I

am much interested in the Observatory and the work which is being done in it, and it is my desire that it shall in no wise be inferior to the most noted of the world's observatories. A noble study is the science of the stars, and one which can not be pursued with too much ardor."

Indeed, so great importance does Leo XIII. attach to the study of astronomy; so much has he at heart the cultivation and advancement of science in general, that he has wished to perpetuate the memory of the establishment of his Observatory in the most signal manner. As is well known, a large and beautiful medal, commemorating the most important event of the year, from an ecclesiastical point of view, is annually struck by the Pope. The medal for 1891, a master-piece by the distinguished engraver, Bianchi, records the institution of the Vatican Observatory, and at the same time declares to the world, in imperishable characters, the magnitude of the service rendered by our pontifical Mæcenæ, not only to astronomy, but also to all the physical sciences as well.

The President of the Administrative Council of the Vatican Observatory is His Eminence, Cardinal Rampolla, Secretary of State to His Holiness. From its foundation he has shown an ardent and active interest in everything that concerned its well-being, and it is not an exaggeration to say that much of the prestige which the Observatory now enjoys is due to the hearty and intelligent manner in which His Emi-

nence has entered into every proposition which was calculated to place this favorite institution of Leo XIII. among the great observatories of the world.

But much as has been done for the Observatory by the Pope and by Cardinals Rampolla and Mo-cenni, it probably would not have won the distinction it now enjoys, had it not been for its learned, zealous and indefatigable director, Padre Denza. From the opening of the Observatory until a few weeks ago, when death suddenly put an end to his brilliant and useful career, the illustrious Barnabite was the soul of the Observatory, so far as the scientific world was concerned. It was he with whom astronomers and the directors of other observatories had to communicate when they desired any information respecting the Vatican Observatory or the work which was there conducted. A profound mathematician, a skillful observer, a patient investigator, an ardent lover of nature, he was in every sense of the word an ideal astronomer, and as such he was recognized by his colleagues throughout the world. Besides this, he had a capacity for work that was simply prodigious and a genius for invention which would have made the fortune of any other man. Indeed, some of the most valuable and ingenious instruments in the Vatican Observatory are the product of the fertile brain of this gifted monk. With all this, he was likewise a prolific writer. The author of numerous and valuable works on astronomy, geodynamics, and meteorology, he was

besides a regular contributor to numerous scientific publications in Italy and elsewhere. The founder of the Italian Meteorological Society, and for the past third of a century its director-general, he was also a member of a large number of the scientific associations in foreign lands, all of which vied with one another in doing him honor. The rival of his illustrious friend, Padre Secchi, whom he resembled in many traits of character; the friend-confidant of Leo XIII., who keenly feels the loss of his devoted astronomer, Padre Denza leaves behind him, in his contributions to science, "a monument more lasting than brass, and more sublime than the regal elevation of pyramids." He was, indeed, a true votary of astronomy, and it will be long before the void occasioned by his untimely death can be filled. "*Brav Uomo*—a great man," said the Holy Father, in speaking of him to me only a few days before his demise. "*Vir rei astronomicæ et physicæ scientissimus*—a man thoroughly versed in astronomy and physics," his august friend wrote of him in his brief, announcing the establishment of the Observatory of the Vatican. And no one who is familiar with the life work of Padre Denza will impugn the truth of the characterization, eulogistic as it is. As to his associates in the astronomical world, they will, I am sure, endorse it as a tribute as truthful as it is well deserved, and there will not be one from Greenwich to Rio Janiero who will not deplore the great loss which their science has sustained in his untimely death.

The assistant director of the Vatican Observatory is Padre Lais, a learned member of the Oratory of St. Philip Neri. For many years he was assistant of Padre Secchi, of whom he was always a great favorite. He possesses all the enthusiasm for astronomical research that so distinguished his renowned friends and masters, and has already achieved marked distinction as a conscientious and successful investigator. Like his lamented friend, Padre Denza, he is a ready and prolific writer as well as a careful observer, and is the author of many contributions on astronomy and meteorology which are of acknowledged merit and permanent value. At present he devotes most of his time to the great international photographic chart of the heavens, and is probably more advanced in this work than any of his colleagues.¹ Certainly no one is more interested in the success of the undertaking than is Padre Lais, and no one has worked more assiduously or intelligently to bring it to an early completion. The soul of enterprise and bonhomie, he is still in the prime of life, and promises to carry on successfully for many decades to come the work so auspiciously begun by Padre Denza.

One of the most zealous collaborators with Padre Lais in the preparation of the photographic chart is Signor Manucci, for a long time the engineer-in-chief of the Vatican. In order to lighten their task,

¹ According to the latest advices, Padre Lais's work on the photographic chart is rapidly approaching completion.

and that the work in the Leonine tower may be carried on uninterruptedly, and that the great equatorial may be in constant use, whenever the weather permits, Padre Lais and Signor Manucci alternate with one another in taking photographs. But even by this arrangement the labor entailed is quite arduous, as any one knows who is familiar with the character of the work to be done, and who knows what a strain there is on the observer when he is required to be at the eye-piece of his telescope for several hours without intermission.

Besides the personnel, already mentioned, of the Observatory, there are several assistants in the various departments who, although less known than those just named, are, nevertheless, doing meritorious work in the cause of science. For this reason their names cannot be passed over in silence. Chief among these are Signor de Andreis, assistant in the department of magnetism and geodynamics, Monsignor Buti, assistant in meteorology, and the Signori Gnoni and Brevitori, Valli, and Kobell, who also fill important positions in this noble temple of Urania.

But, great and important as are the achievements of the working staff of the Observatory, and we have seen how great and important these are, we can never lose sight of the one who made all these brilliant triumphs of science possible. For all time to come, *La Specola Vaticana* will be inseparably linked with the career of the Pontiff, now gloriously reigning, and the name of Leo XIII. will be traced in letters

of gold in the annals of astronomy, as that of one who was not only an ardent lover of this beautiful science, but was also one of its most notable and generous patrons.

Never shall I forget the impression I experienced one night, on my return from the Leonine tower, where I had left Padre Lais engaged in his work of love, photographing the stars. The genial oratorian and myself had spent several hours together in the Observatory, when I was obliged to take leave of him, a prisoner as he was for the night, on a reclining chair under the eye-piece of his superb equatorial. Slowly I wended my way through the solitude of the Vatican gardens, where all was solemn stillness, and passed around the imposing temple of St. Peter's. Presently, I found myself hard by the venerable obelisk in the Piazza de San Pietro. It was now the hour of midnight; I was quite alone, for there was not a soul to be seen or heard.

And yet I was not alone, for on looking up toward the Pope's apartments in the Vatican I discovered that the light in his study had not yet been extinguished. He was not, it is true, engaged in tracing out the path of some shining orb in the distant realm of space, but he was, I felt sure, occupied in something even higher and nobler. While the world below him was slumbering, he was following with his mind's eye the course of human events, or, it may be, he was intent on safeguarding the interests of the three hundred millions who salute him as

father, or on preparing some new message of conciliation, peace, and union to be addressed soon to all the children of men. From the moment of his assumption of the tiara until the present, he has been untiring in bringing out in bold relief the natural and necessary alliance between science and faith, and now he wishes, before closing his glorious career, to crown his splendid life-work by drawing more closely together the divers religious bodies of Christendom, and having them unite in one fold under one shepherd.

Great and valiant Pontiff ! Zealous lover of science, religion, and humanity ! Thy expansive and affectionate heart hath attracted toward itself the hearts of the world. Thy keen and unerring intelligence hath illuminated the councils of princes and of the wise ones of the earth, and men have called thee blessed. Thou hast had compassion on the poor, the weak, the oppressed, the down-trodden, and hast pleaded before the rich and the powerful the cause of the toiling millions of two hemispheres, and for this shall thy name be held in eternal benediction. Well hast thou been designated as *Lumen in Cælo*, Light in Heaven. The record of thy life shows how appropriate has been this epithet, and posterity will ratify a judgment which has been pronounced by a grateful and loving people. The service which thou hast rendered to science is great; that which thou hast rendered to human-kind is incomparably greater.

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CHAPTER IV.

LIGHT AND LIBERTY IN THE STUDY OF SCIENCE.

THE epoch in which we live has received various appellations. By some it has been denominated the Age of Steel, by others the Age of Electricity, and by others still, the Age of Aluminum. There is a reason for each of these different designations, but the Age of Science seems to be with the majority a more favored and a more appropriate name. For there can be no doubt that, as compared with any previous period of the world's history, our age is specially remarkable for the attention which it has given to the natural and physical sciences, and for the marvelous results which have followed their cultivation.

And in some mysterious way science is supposed by many to have brought with it a certain access of light and liberty of thought that could have come from no other source. But this light and liberty and science, we are told, are only for those who have brushed aside the superstitions that faith imposes, and who have broken loose from the fetters that the Church had forged. They are not for the Christian believer, and least of all for consistent

Catholics. The light that illumines the votary of science is not for the Romanist; the liberty about which so much is said, he knows not of; the science that is to revolutionize the world, he may not touch.

So we are assured by the adepts in modern science, by those who are regarded as the leaders of modern thought, by those especially who boast of enjoying all the privileges and prerogatives guaranteed those who have submitted themselves unreservedly to the guidance and tutelage of science as popularly understood.

No one can deny that during the present century, and particularly during the past few decades, wonderful progress has been made in every department of science. The sciences of observation and experiment have received an impetus they never knew before. Light has been thrown on subjects that were previously enveloped in Cimmerian darkness; questions have been answered that have puzzled philosophers since the time of Aristotle; mysteries have been cleared up that even by the wisest of men were wont to be considered as insoluble.

Dame Nature, who has long been as mute as the sphinx about many important problems, has at last yielded to the importunities of her questioners and vouchsafed the information desired. The microscope has revealed a new world that our forefathers never dreamed of — "the world of the infinitely little." The telescope has shown us that the earth and the

solar system are but a speck in a vast universe which apparently knows no limits.

A few years ago the stars of heaven were numbered only by thousands. The great refractors of Washington, Pulkowa, and Mount Hamilton have increased the number from thousands to millions. And now, as a final triumph of science, the photographic camera, in conjunction with the telescope, has demonstrated the existence of untold myriads of stars that are invisible with even the highest powers of the colossal Lick instrument, and has, according to Professor Barnard, placed the number of stars in the Milky Way alone that can be fixed on the sensitized plate at the astounding number of five hundred million or more. Inconceivable as is this number, it is, astronomers assert, but a small fraction of the untold billions of orbs that in this portion of the universe move through the fathomless realms of space. For the luminous spheres whose existence is revealed by the telescope and the camera are insignificant in number as compared with those dark and invisible bodies—extinct suns and dead satellites—that silently and according to fixed laws cycle round and among their light-giving companions.

And yet more. Great as are the triumphs of celestial photography, those of spectrum analysis are still greater. For if, by the telescope and the camera, the number and magnitude, and the distance from us, of the heavenly bodies may be estimated,

at least partially, the spectroscope goes farther and tells us of the motions of these luminaries—whether they are approaching or receding from us—of their relative ages, and of their chemical constitution.

Had any one announced a few decades ago, that before the end of the century astronomers would be able to tell the composition of the sun and stars, of comets and nebulæ, he would have been laughed at as an idle dreamer. But what was then an impossibility is now a demonstrated fact. We know now the constitution of the sun as well, almost, as we know that of the earth, and the spectra of Sirius and Arcturus are as familiar to us as those of lithium and hydrogen.

What has been said of the science of astronomy may be iterated of other sciences—of biology, geology, prehistoric archæology, Egyptology, Assyriology, history, Scriptural exegesis, and other branches of knowledge. A flood of light has been thrown on all of them. Instruments of a precision and a delicacy that were unknown until recent years, and methods of research that were never applied before the present generation have put us in possession of facts of which our predecessors had no conception, and have given us a power of analysis and synthesis that within its own province is well-nigh irresistible.

Ours is indeed an age of light, as regards the inductive sciences and the higher criticism. But is it true that those who profess a belief in Christ and

His Church are deprived of this light? Is it true that dogma and faith cannot coexist with this light? Is it true that the orthodox Christian must be either blind to its existence, or reject *in toto* the teachings of revelation? No, a thousand times no. We can now declare, and as emphatically as St. Clement of Alexandria declared, seventeen hundred years ago: "There is no faith without science, as there is no science without faith." One supplements the other, and they may not be separated without manifest detriment to both.

Positivists would have us believe that science consists simply in the study of facts and phenomena; that the sole subject matter of science is that which may be apprehended by the senses; that the supersensible and matters of faith and revealed truth are unknown and unknowable.

But this is not the view taken by the great thinkers of the world—by Plato, Aristotle, St. Augustine, St. Thomas and their host of followers in every age. Science, according to them, is not a mere dry catalogue of facts; not a superficial inquiring into phenomena, but a knowledge of things through their causes.

Positivists take the part for the whole. They accept the visible and tangible, and reject the invisible and rational. They limit science to what is known as the experimental sciences, and exclude metaphysics and revelation, as beyond and outside of the purview of science.

Such being the case, it is obvious that the positivist school of science, far from enjoying more light, has, on the contrary, less than those who cling to the faith delivered to them by the saints, and who are guided by the philosophy of the Lyceum and the School.

"Experimental intuitions," says Kant in his "Critique of Pure Reason," "separated from the concepts of pure reason, are blind; the concepts of pure reason, separated from experimental intuitions are vain and hollow." Hence, says the learned Cardinal Gonzalez: "Science, which deserves the name, cannot prescind from induction, and induction necessarily carries with it the metaphysical idea of a nexus between the parts of the universe. The legitimate use of the experimental method presupposes the necessity of collecting, classifying and interpreting facts and phenomena—functions which cannot be performed in a truly scientific manner except by the aid of certain rational principles, or as Claude Bernard puts it, 'certain directing ideas.'"

For this reason His Eminence declares that: "A science which is completely separated from rational principles is a science only in name and appearance."

The proof of this statement, if proof were needed, is found in the fact that the great scientists of the world, in every age, have been men who did not hesitate to acknowledge their indebtedness as scientists to the principles of religion and metaphysics.

Copernicus, Galileo, Descartes, Kepler, Pascal, Linnaeus, Newton, Mersenne, Leibnitz, Cuvier, Liebig, Johann Müller, Schwann, Leverrier, Faraday, Ampère, Cauchy, Secchi, Barrande, were all men of deep faith, as well as men of profound science. And what is said of those who are no more can also be affirmed of the living.

The most eminent representatives of science to-day—we do not mean theorists, but those who have accomplished most for the advancement of natural knowledge, and whom the future will regard as the leaders in their respective branches of research—are believers in God, and men of deep religious convictions.

For many years past two men have been prominently before the world as the representatives of modern science. One of them is the famous Louis Pasteur¹—the hero of a thousand victories, the conqueror of the plague, the benefactor of his race, a consistent, loyal, zealous son of the Church Catholic. The other is Ernst Hæckel—the atheistic professor of Germany, the apostle of monism, the one who preaches that the mission of science is to banish from the minds of men the idea of God and substitute in its place the concept of a material atom, of eternal, self-existent matter and force.

“If we do not accept the hypothesis of spontaneous generation,” says Hæckel, “then we must have recourse to the miracle of a supernatural creation,”

¹Died Sept. 28, 1895.

and only those who "renounce their own reason," can believe in a First Cause.

Pasteur not only declares, but has demonstrated beyond cavil or question, that "spontaneous generation is a chimera." And, far from seeing any renunciation of his reason in admitting the existence of a First Cause, his whole life, in word and deed, proclaims his belief not only in the existence of God and his providence, but also in those "eternal verities"—we use his own words—which give a meaning to the laws of nature, and which illumine with a light divine many dark mysteries of the natural order that otherwise would be forever beyond our ken and apprehension.

What we have said of Pasteur we might repeat of his distinguished collaborator and coreligionist, Van Beneden.¹ With the exception of Pasteur, he has perhaps achieved more of permanent scientific value in the domain of natural science, notably biology and geology, than any man living. And, far from finding that his faith enshrouds him in darkness, he would be the first to confess that in many of the difficult problems that have been presented to him for solution, his faith was as a beacon that guided him from afar; a pillar of fire that went before him in the gloom.*

It is not true, then, that those who hold to the traditional doctrines of Christianity are deprived of light, which only unbelievers enjoy, and that they

¹Died January 8, 1894.

are debarred from advantages in the pursuit of science, which they would possess if they were to abjure their faith. On the contrary, to the Christian and the Catholic scientist, especially, may be applied the words of our Divine Master, "He that doeth truth cometh to light."

But what of the second part of our question? Have Catholics the same liberty of thought as those who profess no religious beliefs, and are affiliated to no religious body? Or are they not rather hampered by dogmatic restrictions that make the free exercise of their intellect impossible, and are they not therefore barred, if consistent believers in the tenets of their Church, from certain researches in science which they could pursue *ad libitum* by forswearing their faith? Let us see. These questions are often asked, and will bear more than a superficial examination.

From a Catholic point of view, it is scarcely necessary to observe that the questions propounded are absurd. And this for the simple reason that to the Catholic, liberty and truth are practically synonymous. To him the study of science is the pursuit of truth, and the Church, far from preventing such pursuit, aids and encourages it. The truths of science, as every one who knows his catechism is aware, are one with the truths of faith. No contradiction, therefore, much less antagonism, is possible. Faith and dogma, consequently, far from hampering the scientist in his investigations, in-

crease the measure of his liberty by extending the boundaries of truth.

But these *a priori* reasons, which in themselves are indisputable, are not the only ones we have for believing in the absolute liberty of thought enjoyed by the Catholic scientist. The history of science leaves us in no doubt about the matter. And more conclusive still is the testimony of those who have excelled in science, and who are specially competent to bear witness in the case. Far from feeling trammelled in their researches, they assure us that they enjoy the utmost freedom, and far from fearing that their studies might lead to discoveries contrary to revelation, they assert that all scientific truths must surely and necessarily illustrate and corroborate the truths of faith.

It will suffice here to quote the words of the illustrious Baron Cauchy, the profound scholar, the devoted son of the Church, and the most eminent mathematician of his age. In an address to his students he says to them: "Cultivate with ardor the abstract and the natural sciences; decompose matter; unveil to our surprised vision the wonders of nature, and explore, if possible, all the parts of the universe. Search the annals of nations and the histories of ancient peoples; consult the venerable monuments of past ages found in every part of the globe. Far from being alarmed at such investigations, I should provoke them without ceasing. I should encourage them by my own efforts as well as

by my good wishes. I should not fear that truth might prove to be in contradiction with itself, nor that the facts and documents collected by you would ever be otherwise than in perfect accord with our Sacred Books."

Every one is aware of the perfect liberty of thought always enjoyed by the children of the Church in the discussion of sundry much controverted questions of Genesis and other parts of the Old Testament. Most of these questions are rather questions of science than of faith and morals, and as such are left to the disputation of scientists and theologians. The various views entertained by the Greek and Latin Doctors regarding questions of cosmogony and Scriptural chronology are familiar to all students of science and religion. That they experienced the most perfect intellectual freedom is attested by both their words and works. The same mental freedom was proclaimed and enjoyed by the Schoolmen, and the same liberty of thought is the prerogative of every Catholic of our own day as well.

St. Thomas and St. Augustine assert the authority of science and reason in their own sphere, even as against the apparently contradictory declarations of Scripture. The illustrious Bishop of Hippo tells us explicitly that "if to manifest certain reason be objected an authority of Scripture, he does not understand who doth so, and does not object to the truth, the real sense of Scripture to which he can not at-

tain, but his own." And St. Thomas warns us in the most positive manner to beware of contradicting certain results attained experimentally by men of science, "lest, on the one hand, we should close to them the way of salvation, and, on the other, be found to have canonized for Scripture our own whimsies."

But let us take a crucial test of the liberty of thought enjoyed by Catholics in matters of science. We have it at hand in the all-absorbing question of organic evolution, about which so much is said and written, but which is so ill understood in its bearing on the teachings of faith. There are many who believe that the immediate specific creation by God of all forms of plant and animal life is explicitly taught by Scripture, and is, consequently, an article of faith that may not be questioned, much less impugned. To those who are so minded, evolution is nothing short of rank heresy. It is a question that is offensive to pious ears, and one that no believer in the integrity of the Scriptures and of Church dogma should touch.

There are others, however—learned scientists, distinguished theologians, and loyal sons of the Church—who take quite the opposite view. They know that the Church has not pronounced on the subject, and they are satisfied that the words of Genesis cannot be construed so as clearly and formally to declare the doctrine of specific and immediate creation.

On the contrary, to them the words of the Sacred Text seem to indicate, if not to favor, creation by secondary causes, or evolution. And when one comes to examine the point carefully, one is satisfied that no less an authority than St. Augustine has laid down principles that will permit us to accept the theistic doctrine of evolution as now taught.

Of course, it is quite evident that St. Augustine had no idea of evolution in the form in which it is held to-day, but the principles which he maintained are quite consistent with the teachings of those evolutionists who conserve the creative act of God. He distinguished clearly between creation, properly so called—*opus creationis*—and the formation of creatures—*opus formationis*—from pre-existing matter.

In the first case we have direct and immediate creation; in the second, development, or evolution from primitive germs, by the operation of natural forces. To the laws which determine the development from these germs of the various forms of plant and animal life, the saint gives the name "causal reasons." Indeed, the saint's intuitive perception of the necessary reign of law in both the inorganic and organic worlds is one of the most distinguishing characteristics of his genius. Like the great Stagirite philosopher, he seemed by sheer force and lucidity of intellect to forestall many of the most important conclusions of modern experimental science.

All reasonable minds must be at one as to the

fact of creation. It is one of the first postulates of sound philosophy. "In the beginning God created heaven and earth." But the manner in which God created the visible universe and the various forms of animate nature is past our finding out. Nothing short of divine revelation can afford us positive knowledge regarding the matter—something which we can safely assume will never be vouchsafed us.

All that, as Catholics, we are obliged to believe, in respect of the creation of the earth and of the creatures that inhabit it, is: first, that God created matter and force; and secondly, that he created the soul of man.

Whether the various forms of animate and inanimate nature were created directly, or by the operation of secondary causes, whether God called them into being by an immediate act of creative power, or by a slow process of evolution—by the operation of the *causales rationes* of St. Augustine—we know not.

The Scripture is silent on this point, and the Church has defined nothing beyond what is contained in the first article of the creed: "I believe in God, the Father Almighty, Creator of heaven and earth."

That there is not in this theistic conception of evolution anything contrary to Catholic dogma follows, as a necessary corollary, from fundamental principles of theology.

Whether the theory of evolution be true or not

is quite another question. With this we have now nothing to do. From present indications, it is most probable that it will never get beyond the more or less theoretical stage which it now occupies. To many it appears to be the more probable theory. And to many also it seems to afford a more exalted notion of the power and wisdom of the Creator, than the view of specific and successive creations that has so long obtained.

But so far as the Church is concerned, we are at perfect liberty to elect whichever theory appeals to our minds as the more probable and the more conformable to reason. As a matter of fact, some of the ablest scientists and theologians of the Church to-day give a decided preference to the theory of organic evolution, and do not hesitate to defend it whenever occasion offers.

M. Albert Gaudry, the distinguished palæontologist and member of the French Institute, speaking of evolution, says it is the "hypothesis which I prefer, but whether it be adopted or not, it appears certain that there has been a plan." At the conclusion of the introduction to his profound work, "*Les Enchaînements du Monde Animal*," in which he advocates the theory of evolution, he declares: "How little sceever we may be, it is a pleasure and even a duty, too, for us to study nature, because nature is a pure mirror in which is reflected the Divine Beauty."

The illustrious Belgian geologist and devout Catholic, d'Omalius d'Halloy, referring to the same

subject, expresses himself as follows: "I find it difficult to believe that the Almighty Being whom I consider as the author of nature, has at divers epochs destroyed all living beings in order to give Himself the pleasure of creating new ones which, although formed on the same general plan, present successive differences, while tending toward the forms now existing."

To show on the other hand, how far evolution is from being anything more than a theory, it will suffice to state that an eminent French scientist has challenged any one to point to a single instance of the transformation of species in the animal kingdom, and as a mark of his good faith has declared his readiness to bring before the Academy of Sciences any such result, by whomsoever discovered, in order to give as great publicity as possible to the fact, and to proclaim before the world the triumph of the author. As yet, however, the challenge has not been accepted. The test is as difficult to meet now as it was when proposed by the illustrious Scotch geologist, Hugh Miller, more than a third of a century ago.

There can, therefore, be no doubt about the fact that the Catholic scientist enjoys the fullest liberty in the study and discussion of scientific questions, as there can be no doubt that faith and Christian philosophy are to him a source of illumination that agnostics and atheists do not and can not possess. But liberty is not license. The liberty which the

positivist and the unbeliever boast of is what St. Augustine calls the "liberty of ruin," a liberty that always degenerates into intellectual and moral slavery. The Church never represses liberty of thought, nor does she ever condemn freedom of discussion. She does, however, condemn what Leo XIII. has aptly termed "madness of opinions."

"It is, therefore," declares the Holy Father in his celebrated encyclical *"Immortale Dei,"* "simply a calumny to say that the Church rejects promiscuously the fruits of the spirit of our times. She condemns madness of opinions; she condemns wicked designs of discord, and especially that habit of mind in which are seen the beginnings of a voluntary departure from God; but since all that is true must come from God, whatever of truth may be attained by investigation the Church recognizes as a kind of footprint of the Divine Intellect. And since there is in nature no truth which can detract from the faith due to revelation, but rather much to confirm that faith, and since every discovery of truth may incite either to knowing or praising God, whatever increase the domain of science may receive will always be gratifying and pleasing to the Church; and she will, according to her custom, foster and advance the branches that unfold a knowledge of nature, as she fosters other branches of learning. In these studies of nature the Church does not oppose any new discovery; she makes no opposition to the seeking of the adornments and comforts of life; in fact, an

enemy to sloth and idleness, she ardently desires that the minds of men be exercised and cultivated so as to bring forth abundant fruits; she supplies incentives to every kind of arts and works; and directing by her divine efficacy all these things to what is honorable and salutary, she strives to prevent the intelligence and industry of man from turning him away from God and heavenly good things."

It is important for us to remember, when we hear infidel scientists prating about light and mental liberty being their sole heritage, that we live in an age of fantastical speculation and intellectual anarchy; in an age which mistakes idle and changing hypotheses for veritable science; in an age which ignores God, the Lord of Science.

With truth, therefore, does the distinguished Catholic savant, the Marquis de Nadaillac, affirm that "In the troubled state of modern society, in the midst of the disorder of ideas of which we are the sorrowful witnesses, science has become more dogmatic and more imperious than ever was religion. It counts by thousands its adepts who speak with emphasis of modern science, without knowing the first word about it. I mistake; they have been told that modern science is the negation of creation, the denial of the Creator. God belongs to the old regime; the idea of his justice weighs upon our enervated consciences. They accept without reflection and applaud without reserve everything which seems

to warrant their regarding His action as an unproved hypothesis."

But let us not be disturbed by the wild talk and extravagant theories that are now the vogue. We need not the feeble light of the glow-worm when we are basking in the sunshine of Truth. We desire not the "liberty of ruin," the license of the atheist and the anarchist, so long as we are in the enjoyment of the liberty secured us by Holy Church—the liberty of the sons of God.

No, we repeat, Catholics are not deprived of liberty of thought in anything that can be interpreted as a proper subject for scientific investigation, or for the legitimate exercise of their reason. "Do not," exclaims the eloquent Père Monsabré, in one of his conferences on theological science, "talk, like the ignorant, of the enslavement of reason. Without reason, theology would not exist, for it is nothing else than the application of the logical faculties—comparative and methodical—to revealed principles. Theology bears reason with it to the throne which it occupies on the highest elevation of the scientific world."

Whatever may be the attitude of certain scientists toward the Church, the relations of the sciences of faith with those of reason cannot be other than harmonious. And it is this harmony which springs from the very nature of the relation of science and faith that is the surest evidence of that light and liberty of thought and research which

every Catholic feels is a portion of his Christian heritage.

We may then confidently look forward to a synthesis of all the sciences in the scheme of faith. Such must be the result of the legitimate development of science, and of a better understanding of its relations to revealed truth. It is a consummation that has long and earnestly been wished, and which may be nearer realization than even the most sanguine of us would dare to imagine.

The illustrious Schlegel, who was led by science to the fold of truth, said at the beginning of the century that: "The reunion in faith of all the sciences, is, in the knowledge of the invisible, a new career which shall be more important in its results than was, three hundred years ago, the discovery of another hemisphere; than was the discovery of the true theory of astronomy, or than ever was any other discovery whatsoever."

When this happy day shall arrive the Church will be able to carry on her work under ideal conditions, and the apparent antagonism between science and religion will be no more. This will mark a happy epoch in the history of our race—an era of light and liberty in the study of all sciences, human and divine.

CHAPTER V.

ROMAN CATHOLICS AND SCIENTIFIC FREEDOM.

OURS is pre-eminently an age of intellectual activity. And nowhere is this activity more marked than in the domain of certain of the inductive sciences, especially the newer sciences of biology, geology, anthropology, and prehistoric archæology. During the last few decades, particularly, these branches of knowledge have been invested with a human interest that is not possessed by any of the other natural sciences. The reason is obvious. Their conclusions have a more direct bearing on the traditional teachings of Christianity, whilst their tendencies are supposed, by many at least, to be the reverse of those of faith and dogma. More than this; matters have come to such a pass in some quarters, that we are gravely informed that we must now choose as our guide either science or the Church. We cannot, we are told, follow the teachings of both, because, we are assured, they are hopelessly irreconcilable. If we still cling to the Church and profess belief in her dogmas; if we accept the Bible as a divinely inspired record, we must, to be consistent, reject the conclusions of science. But if

we elect science as our teacher, then we must, completely and forever, sever our connection with the Church of our fathers, and cast aside, as false and superstitious, the beliefs of our earlier years, beliefs too, that for so many long centuries have been the solace and the happiness of the major portion of civilized humanity. We are told, furthermore, that, as a consequence of the antagonism existing between the teachings of science and the doctrines of the Church, all loyal members of the different Christian communions, especially those who are affiliated to the oldest and most numerous Christian body—the Catholic Church—are *ipso facto* debarred from the enjoyment of that intellectual freedom, which we are wont to believe is one of the inalienable rights of man. Christian believers who would devote themselves to the pursuit of science are, it is averred, necessarily so hampered by Scriptural restrictions and forms of dogma, that they are incapable of bringing to the study of nature that unbiased condition of mind that is so essential to the investigator, and without which all his conclusions are colored and warped. In a word, believers in dogma, especially Catholic dogma, do not, and cannot, enjoy that freedom of thought, which is the privilege of those who have rejected all forms of religious teaching, and who have submitted themselves wholly and unreservedly to the guidance of science.

This is a question that has at all times attracted attention, but at no period of the world's history

more than at present. It will, therefore, bear an examination, and if it shall appear that the impression now so prevalent, is false and unfounded, it will necessitate a revision of views that have been so long current regarding the attitude of science toward religious beliefs. And if it shall be evinced that the Catholic, who is usually reputed to be the most enthralled by faith and dogma, is not only entirely unfettered, but, on the contrary, enjoys the highest degree of intellectual freedom, then we may safely assume that all Christian communicants enjoy the same liberty of thought, so far as revealed truth is concerned, and that the intellectual thralldom we hear so much of is the veriest chimera.

I purpose, then, in this chapter briefly to consider the attitude of the Church toward the pursuit of science, as evidenced by the ordinary magisterium of the Pontiffs and Doctors of the Church, and by the declarations and labors of those of her children who have devoted their lives to the study of nature, and whose splendid achievements in every department of science constitute a most valuable portion of the undying patrimony of our race.

It is scarcely necessary to premise that all orthodox Christians deny not only the existence, but even the possibility of any conflict between science and revelation. It is impossible that revealed and demonstrated truths should not agree, because it is impossible that God should contradict Himself. All truths of the natural, as well as of the supernat-

ural, order proceed from Him, and a conflict, therefore, can never be more than apparent. It may not always be possible at a given time to show their agreement, but it can never be demonstrated that they are contradictory. For it may happen, and occasionally does happen, that the conclusions of science appear to contravene certain articles of faith, when in reality the apparent discord is due entirely to misapprehension of the teachings of faith, or to a misinterpretation of the facts of nature. In such cases the difficulty is but temporary, and is sure to disappear with a better understanding of the facts involved. The dicta, then, that God cannot contradict Himself; that science must bear the same testimony as revelation; that one must corroborate the other; that they both must speak the same truths, although in different tongues; that there can never be more than apparent antagonism, are, for the Catholic, as so many truisms that no more require demonstration than the axioms of mathematics. St. Augustine forcibly expresses this idea in a few words when he declares that "every argument, however specious it may be, adduced against the authority of Scripture, deceives by the semblance of truth, for true it cannot be."

In matters pertaining to faith and morals, the Church has never spoken with a faltering or uncertain voice, but regarding questions of philosophy and science that have no direct bearing on dogma, she has always permitted the greatest liberty of

thought and freedom of discussion. We have most striking instances of this in the works of the early Fathers and Doctors regarding questions that long ages ago, contrary to what is often thought, were the occasion of as much study and controversy as they are now in the closing decade of the nineteenth century. Among these much-mooted questions were those that referred to the Mosaic cosmogony, the Noachian Deluge, the chronology of the Bible, and the age of the human race.

According to the allegorical system of the Alexandrine School, of which Origen, Athanasius, and Clement of Alexandria were the most distinguished exponents, all things were created simultaneously, by the *fiat* of Omnipotence, and the days of creation mentioned in Genesis are to be taken not in a literal, but in a metaphorical sense. The Syrian School, represented by St. Ephrem and St. John Chrysostom, held the very opposite view. They stanchly advocated the literal interpretation of Genesis, and maintained that the Genesiac days were days of twenty-four hours each. The celebrated Greek Doctors, St. Gregory Nazianzen, St. Basil, and his brother, St. Gregory of Nyssa, who were the chief representatives of what is often called the Cappadocian School, because they were from Cappadocia, professed what was in reality a sort of synthesis of the teaching of the Alexandrine and Syrian Schools. They taught that matter was first created in its primal, elementary condition, and that it was after-

ward, during the six days, which were understood in a literal sense, fashioned into various forms as recorded in Genesis. This opinion was subsequently adopted by the great Latin Doctors, St. Ambrose and Gregory the Great.

What will surprise those who are wont to regard all great scientific conceptions as being of modern date is the fact that we find in the "Hexaëmeron" of St. Gregory of Nyssa the germs of the celebrated nebular hypothesis of Laplace. Indeed, the whole of his great work on Genesis is based on the truth of this assumption. But the masterly work of the renowned Latin Doctor, St. Augustine, on the days of creation, "De Genesi ad Litteram," is by far the most complete and comprehensive treatise on the subject that the early Church has given us. He admits the simultaneous creation of the Alexandrians, but repudiates the Syrian and Cappadocian interpretation of the six days. Instead of days he demands indeterminate intervals of time—*volumnia sæculorum*. His interpretation is essentially the same as that given by modern exegesis, of which he may justly be regarded as the prophet and precursor. A knowledge of geology and astronomy, as now understood, would have furnished him with a key to many difficulties that in his day were insuperable, because of the impossibility of arriving at correct notions of cosmogony. He was cognizant of what was lacking to complete his view of the work of creation, and was willing to leave to others, and to the future,

the development of the ideas to which he had given twenty-five of the best years of his life.

The diversity of views entertained by the various schools and authorities just named, regarding the interpretation of the Mosaic days of creation, admirably illustrates the liberty of thought which the Church has always permitted her children in matters not connected with faith and morals. The same freedom of thought and discussion has likewise been allowed regarding the Noachian deluge, the chronology of the Bible, the age of the human race, and other similar questions, which come within the purview of profane science rather than that of faith or revealed truth.

And the illustrious Fathers and Doctors just named not only show by their writings that they enjoyed full liberty of thought in all questions of science, but they tell us so in words that cannot be misunderstood. The Angel of the Schools, St. Thomas Aquinas, indicates the spirit which should animate all who treat such debatable questions as those just mentioned. "As," he says, "Holy writ may be explained in many ways, no one should cling so tenaciously to any particular explanation as to venture to maintain it, when, by any conclusive argument—*certa ratione*—it is evident that what one thought to be the sense of Scripture is false." In matters of science, then, we must trust to reason, observation and experiment, and demand proofs for all that is proposed for our acceptance. In the lan-

guage of the great Bishop of Hippo, we must always be on our guard against "the seductive loquacity of a false philosophy, and the timid superstition of a false religion;"¹ against what the great Apostle of the Gentiles calls "loftiness of words" and "vain deceit," and be ever prepared to exhibit a reasonable assent to the dictates of religion and the dogmas of the Church that commands our allegiance.

The teachings of Popes and Councils have been in perfect accord with those of Fathers and Doctors. The words of the Council of the Vatican, to go no further, are so explicit on this point as to need no commentary. "The Church," it declares, "does not forbid the human sciences to make use of, each in its own domain, their own principles and methods."² In his admirable encyclical, "*Æterni Patris*," our Holy Father, Leo XIII., makes the same statement in almost identical terms. "In those points of doctrine," writes the illustrious Pontiff, "which the human intelligence is able to apprehend by its natural powers, it is right that philosophy should be left to its own methods, and principles, and arguments, provided, however, that it do not audaciously withdraw itself from divine authority."³ In his encyclical on

¹ *Neque falsæ philosophiæ loquacitate seducamur, neque falsæ religionis superstitione terreamur.*

² *Nec sane ipsa vetat hujusmodi disciplinæ in suo quæque ambitu propriis utantur principiis et propria methoda.*

³ *In iis autem doctrinarum capitibus quæ percipere humana intelligentia naturaliter potest, æquum plane est, sua methoda, suisque principiis et argumentis uti philosophiam; non ita tamen, ut auctoritati divinæ sese audacter subtrahere videatur.*

"Human Liberty" the same enlightened head of the Church observes that, "It is not to be forgotten that there is an immense field for the free exercise of the activity and of the minds of men in those things, namely, which have no necessary relation to the teachings of faith and Christian morals, or concerning which the Church, without using her authority, leaves the judgment of the learned entire and free."¹ Pius IX., Benedict XIV., and other Popes, whom it were easy to quote, if necessary, safeguard the liberty of thought of the children of the faith, in language equally clear and decisive.

But the Roman Pontiffs are not satisfied with words. They show by their actions, by the encouragement they have given men of science in their researches, that they not only permit, but favor the fullest exercise of freedom of thought and inquiry. And what is more, they have encouraged this liberty of thought and investigation in matters which the timid and ill-informed have considered it inexpedient and injudicious to touch, and in matters, too, which those not in sympathy with the Church, would have us believe, she is afraid to examine, or have examined by others. A few instances—many similar ones might be adduced—will illustrate the truth of this statement.

¹ Denique prætereundum non est, immensum patere campum, in quo hominum excurrere industria, seseque exercere ingenia libere queant; res scilicet quæ cum doctrina fidei morumque christianarum non habent necessariam cognitionem, vel de quibus Ecclesia, nulla adhibita sua auctoritate, judicium eruditorum relinquunt integrum ac liberum.

Thus when Champollion's discovery of the Egyptian hieroglyphics was announced in Europe, "timid minds" says Cardinal Wiseman, "took alarm and reprobated it as tending to lead men to dangerous investigations. It was feared, apparently, that the early Egyptian history thus brought to light, would be employed, as that of the Chaldeans and Assyrians had been in the last century, for the purpose of impugning the Mosaic annals." But the then reigning Pontiff, Leo XII, did not share such unfounded fears. On the contrary, he saw that the discovery would be of valuable service to religion, and invited the distinguished savant to prepare a work relating to the obelisks of Rome, which was printed and engraved at the Pope's expense. In referring to this matter in a letter to his friend, Cardinal Wiseman, Champollion writes: "It is a real service which His Holiness renders to science, and I shall be happy if you will be good enough to place at his feet the homage of my profound acknowledgment."

So, too, was it when the first discoveries were made regarding Quaternary Man. The shouts of triumph raised by the enemies of revelation at the prospect opened up by the discovery of fossil man were indeed calculated to inspire apprehension and distrust in the minds of those who had not made any special study of geology and archæology, but, who, on the contrary, had been led to regard such studies as having a tendency inimical to the Inspired Record. Pius IX., however, like his predecessor, Leo XII.,

showed that far from endangering the teachings of faith, such researches would rather tend to illustrate and corroborate them. This he did in a signal manner by his patronage of the eminent archæologist, Michele de Rossi, during his exhaustive investigations regarding Quaternary Man in the environs of Rome.

But it may be urged that the examples of the Popes, in encouraging scientific research, are no indication and still less a guarantee of liberty of thought on the part of their subjects, and cannot be so construed. Let us see.

In 1867 a memoir was read before the Congress of Anthropology and Prehistoric Archæology, at Paris, announcing a discovery that, it was claimed, proved beyond doubt the existence of Tertiary Man. The discovery consisted of certain flints found at Thenay, in France, which were so fashioned that their discoverer maintained that they were unmistakably the work of human hands. The members of the Congress were amazed, and it requires much to surprise a modern anthropologist or archæologist. The discovery was indeed so startling and so far-reaching in its significance, that it seemed imperatively to demand an immediate revision of all views previously entertained by both orthodox Christians and men of science regarding the age of our race. Biblical chronology appeared to be completely disproved, and it looked as if the truth and integrity of the Sacred Scriptures were jeopardized beyond all hope

of salvation. "At last," exclaimed infidel scientists, "one *fact*, whose meaning is as obvious as it is unmistakable, has been adduced, that is diametrically opposed to the teaching of the Bible and theologians, regarding the antiquity of man." A shout of triumph went up from the enemies of revealed truth, and the Holy Scriptures, as an inspired record, was relegated to the limbo of myths and dead superstitions.

But who was the author of the memoir that created such a sensation among scientific men? Who was the discoverer of the flints that at once became the nine days' wonder of the civilized world? He was a pious French priest. He was also a learned theologian, and at the same time one of the most accomplished archæologists in Europe. But, true scientist that he was, he was a student of facts, and utterly free from all preconceived notions regarding the significance of the facts he observed. He had no favorite theory to defend, nor pet hypothesis to exploit. He accepted the facts as he found them, and was willing to let his inductions from them stand the test of criticism. The facts, to his mind, conclusively proved the existence of Tertiary Man, and for this reason Abbé Bourgeois was, until the day of his death, Tertiary Man's most ardent and consistent defender. It was subsequently shown that he, together with the majority of the archæologists of Europe, had misinterpreted the facts in the case; that the flints he discovered were not of human

manufacture, and that Tertiary Man was something entirely imaginary.

This, however, matters not. During the many years he devoted to his researches, which seemed to many to presage the certain undermining of all Scriptural authority, Abbé Burgeois was never interfered with by his ecclesiastical superiors, and still less, was any Papal influence brought to bear on him to cause him to abandon his investigations, or to suppress the results to which they gave rise. He was always perfectly free and untrammelled, and never for a day, so far as the Church was concerned, did he cease to enjoy the highest degree of scientific freedom. More than this, some of his strongest sympathizers and most earnest collaborators, notably the distinguished archæologist, Abbé Delaunay, were zealous and loyal ecclesiastics. The Catholic press of Europe was freely placed at his disposition for an exposition of his views, and he, everywhere and on all occasions, received from his confrères in religion that kindly consideration to which his profound science and earnest piety entitled him.

As for himself, he never for a moment experienced any doubts about the ultimate bearing of his discoveries on revelation. He did not, like many who were less informed as to the doctrines of their faith, see in his researches anything to justify one in concluding that the teachings of science are hostile to those of the Church, or irreconcilable with the declarations of Scripture. He was too good a theo-

logian for that. His discoveries, like many others that had been made before in divers departments of knowledge, might, indeed, be contrary to current opinions, and apparently contradictory to certain declarations of Holy Writ, but the contradiction was no more than apparent. He trusted to the future for light, and to further and more extended investigation to clear up difficulties that for the moment were insoluble. And has not the sequel justified the wisdom of his attitude in the premises, and is not his example worthy of imitation by all true votaries of science, and by all advocates of revealed religion as well?

But, startling as was the announcement made by the Abbé Bourgeois, it was not more so than the theory of Preadamites, a conjectural race of men which became extinct long before the creation of the traditional father of the human species that was so strongly championed by two other well-known Churchmen—the Abbé Fabre d'Envieu and the distinguished oratorian, Abbé Valroger. And notwithstanding that their theory was apparently contrary to dogma, and subversive of Scriptural teaching, these devoted sons of the Church were left completely undisturbed by ecclesiastical authority. Far from being the victims of the thunderbolts of the Vatican and the persecutions of the inquisition, they continued, to the end of their lives, to enjoy the fullest measure of liberty of thought and freedom of expression.

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What has already been said should convince any unbiased mind that Catholics do, of a truth, enjoy all the scientific freedom in every department of knowledge that the human mind can demand. But, in order to clinch the argument, I shall let some of most distinguished representatives of modern scientific and philosophic thought testify for themselves, as well as for their brethren in the faith.

The illustrious French chemist, M. J. B. Dumas, perpetual secretary of the French Academy of Sciences, declares in one of his admirable *Éloges* that "Faith does not kill science, and science kills faith still less."

Rosellini, the learned collaborator of Champollion, in referring to those who were raising an outcry against the discovery of the distinguished Frenchman, truthfully observes that "This truth is founded on eternal bases; neither can the envy of man deface it. And if men eminent for their piety and learning admit the new system, what has revelation to fear from it?"

Pasteur, in the beautiful discourse pronounced by him on the occasion of his reception into the French Academy, does not hesitate to declare that, "If we were deprived of these conceptions"—the truths of faith—"the sciences would lose that grandeur which they draw from their secret relations with the infinite verities."

Baron Cauchy, the greatest mathematician of his age, who, according to one of his fellow associates

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of the French Institute, possessed the combined genius of Euler, Lagrange, Laplace, Gauss, and Jacobi, affirms that, "It is precisely because it is exact and true that the Christian religion is so eminently favorable to the progress of the sciences, and to the most noble faculties of our intelligence."

. . . "It is because it is exact and true that it presides at the sublime meditations of the Augustines, the Descarteses, the Newtons, the Fermats, the Maclaurins, the Pascals, the Linnæuses, the Eulers, the Copernicuses, the Tycho-Brahes, the Cassinis, of all those great men of all ages, who in the contemplation of nature and of the admirable laws established by the Creator, found without ceasing new motives to bless and adore the author of so great marvels." . . . "I have made a profound study of the human sciences, especially those that are called the exact sciences, and I have more and more recognized the truth of those words of Bacon, 'A little philosophy inclineth a man's mind to atheism, but depth in philosophy bringeth men's minds about to religion.'"

The erudite historian and Orientalist, François Lenormant, a famous son of a noble sire, writes in the preface of his great work, "*Histoire Ancienne de l'Orient*": "I am a Christian, and I proclaim it loudly. But my faith is not affrighted at any of the discoveries of criticism when they are true. A devoted son of the Church in all necessary things, I claim with the more ardor the rights of scientific

liberty. And from the very fact that I am a Christian, I regard myself as being more completely in the sense and in the spirit of science than those who have the misfortune not to possess the faith."

"There is not," avers Father Searle, the accomplished Paulist astronomer, "a single point in the whole edifice of Catholic faith which we do not undertake to rest on the rock of reasonable evidence, to begin with, and to support by corroborative proofs through all these eighteen centuries."

And thus I might go on with scores of similar witnesses to the fact that nowhere is there greater intellectual liberty than within the pale of the Catholic Church, and that none more than her sons enjoy all the rights and prerogatives of scientific freedom.

A Catholic may not, it is true, proclaim with M. Duval, that "science is the elimination of the supernatural in the explanation of natural things." He may not endeavor, like Hæckel, the apostle of Monism, to replace the Creator by abiogenesis, or spontaneous generation; or hold with Büchner, that "God is only another expression for our ignorance," or that "every science, and especially every philosophy that seeks reality instead of appearance, truth instead of pretence, *must necessarily be atheistic*." This is not intellectual liberty; it is intellectual license, as irrational as it is unscientific and unnatural. Hæckel and his school may, if it so please them, descant on "the plastidule soul," and dilate on "the potentialities of carbon"; Vogt may hold

that "the brain secretes thought as the liver does bile," or that "all vital action is the result of the molecular forces of the protoplasm that displays it;" but Catholic men of science object to being forced to accept such vagaries as veritable science. Some one has remarked that modern science is more dogmatic than religion has ever been. If by the term "science" be meant the wild theories and fanciful speculations of a certain class of contemporary scientists, the statement is perfectly just. For it is a truth, which no one conversant with the facts will gainsay, that the most dogmatic people in the world to-day are certain scientific theorists of the evolutionary and atheistic schools of thought.

The mistake is that these men reject every induction and every proposition that does not rest on the testimony of the senses. The data of metaphysics, and the truths of revelation, contrary to the teachings of sound philosophy, are proscribed as extra-scientific, or anti-scientific. A first cause is excluded from the domain of science, and relegated to that of mysticism, because, say Littré and Spencer, a first cause is *unknowable*. They do not believe in the existence of a personal God, because, like Lalande, they are unable to see Him with their telescopes. With Broussais, they deny that there is a soul, because they have never detected it with their scalpels. They would prove the existence of a Creator by the spectroscope, as they disclose the existence of certain terrestrial elements in the sun

and the stars. They look for the soul at the bottom of their crucibles and retorts, and not finding it there, gravely inform us that it is a fantastic conceit that might find acceptance during the "Ages of Faith," but which can have no place in this age of science and criticism.

But this extravagant and irreligious teaching is not new in the history of science. In 1806 the French Institute counted more than eighty different theories hostile to the Sacred Scriptures, which had been developed in less than half a century. Not a single one of them now remains. Since 1806, hundreds, yea, thousands of other equally fanciful theories have been evolved, and all of them have already been consigned to oblivion.

One can then say truthfully of much of what is paraded before the world as "modern science" what Edgar Quinet in his "*Le Genie des Religions*" observes of the "higher criticism": "At first everything seems to be changed by its discoveries; but when you recover from the shock and really look into it, you find such a medley of visionary conjecture and reckless theorizing that you despair of founding anything thereupon."

Not without reason, therefore, does the Apostle of the Gentiles warn us not to be "led away with various and strange doctrines." And foreseeing the dangers to which the children of the faith will be exposed, he exhorts them to "prove all things," and to "hold fast that which is good." By thus

acting, by refusing our consent to what does not approve itself to our reason, we exercise to the fullest extent that liberty of thought which we have never forfeited, and which the Church would be the last to have us forfeit. No one, then, more than the orthodox Christian, no one more than the consistent Catholic, is in a better position to realize in all their truth those beautiful words of our divine Master: "And you shall know the truth, and the truth shall make you free."

CHAPTER VI.

THE STUDY OF SCIENCE IN OUR ECCLESIASTICAL SEMINARIES.¹

THE distinguishing characteristic of our age, aside from the eager pursuit of the almighty dollar, is the intense ardor it displays in the cultivation of the natural and physical sciences. In no period of history has there ever been manifested anything which approaches the interest which is now centered in the study of the inductive sciences, and often to the exclusion of other branches of knowledge which are of equal, if not of greater importance. What the Renaissance was for art and letters, the period of which we have witnessed the beginning seems destined to become for the sciences of observation and experiment. The science of the earth and the science of the stars; the science of animal and vegetable life; the science of matter and the science of the divers forces of nature; the science of the infinitely little and the science of the infinitely great in the material universe—these are the sciences which at the present moment are absorbing almost entirely the best energies of the master intellects of the world.

¹Read before the International Catholic Scientific Congress, Brussels, September, 1894.

Theology and philosophy are still studied, it is true; art and literature have yet their votaries as of yore, but their importance, in the estimation of the general public at least, is quite eclipsed by the sciences of physics and chemistry, geology and biology, astronomy and paleontology, ethnology, and archæology. And more than this. Not only are theology and philosophy, art and literature, dwarfed beside the newer sciences of these latter days, but they are tinctured and modified by them to a degree that would seem almost incredible to one who has not kept abreast with the giant strides which science has made, especially during the past few decades.

As an illustration of the effect which science and scientific theories may have on philosophy and theology, as well as on literature and history, I need only instance the important role at present played by the theory of evolution. We have now not only a philosophy of evolution, but evolutionary philosophies, and evolutionary theologies as well. A majority of our contemporary writers now assume evolution as a demonstrated fact, and their works are written in the light which evolution is supposed to shed on every branch of knowledge, sacred and profane; and, great as is the number who have already given in their adhesion to the theory of evolution, the number is still increasing, and at a pace which is almost bewildering. The spirit of evolution is ubiquitous, and its influence not only permeates, but dominates,

every department of thought. But the spirit of evolution is the spirit of modern science; since evolution, as now understood, is the direct offspring of modern scientific research. To see to what an extent philosophy, theology, history, and literature have been affected by contemporary science, and by evolutionary teaching, one need only take up any one of the countless works on these topics which have appeared during the generation just ending. The influence is especially conspicuous in the works of non-Catholic authors, but even in the case of Catholics, who are naturally more conservative, the effect is noticeable and often striking. The *zeitgeist* with which we must now reckon—and we cannot realize this fact too soon—is the spirit of science, the spirit of evolution, and the spirit, too, of most of the scepticism, and materialism, and atheism which are now so rife, and which have been engendered by false views of nature, and erroneous inductions from facts observed.

And this *zeitgeist*—this spirit of false science, this spirit of error—is, be it remembered, the greatest enemy against which we have to contend. In the early ages of the Church the war was against paganism, and its protean errors; during the Middle Ages it was against a false philosophy, and the dangerous teachings of Mohammedan doctors; while during the period of the great apostacy of the sixteenth century, and the times immediately subsequent, the war was for the conservation of the re-

ligion of Christ against those who would impose on the Church the fictions of men. In every age, from the dawn of Christianity until the present time, the battle fought was one of true against false religion. It was a battle of the Church of God against the superstitious practices of paganism, the perverse doctrines of Mohammed, and the religious errors of Luther and his asseclæ.

Now, however, it is different. The contest is no longer between religions true and false, but it is a contest of religion with irreligion—a contest with infidelity, agnosticism, atheism. The issue is no longer one between Catholicity and Protestantism. Protestantism as a system of religious error is practically a thing of the past, so far as the Church is concerned. The issue is now between Catholicity on the one hand and agnosticism in its various phases on the other. And this issue, let us bear in mind, is not one which has arisen from theological controversy, nor philosophical speculation, but one which has originated in the multifarious scientific discussions which have followed the investigations and discoveries of modern inductive science.

Knowing, then, what our enemy is, and the nature of the forces on which he relies for ultimate victory, it behooves us to take measures accordingly. The time of reconnoitring is past; the conflict is imminent and threatens to be long and desperate. Our duty is manifest. It is to arise in all haste, and to prepare to defend the Christian citadel which has withstood

so many onslaughts in times past; and which, if her custodians do their duty we know beforehand will pass unscathed through the mighty assault now impending. The battle is, as before, one against the spirit of darkness, and the Lord who has promised protection to His Church, will not fail to come to the assistance of those who invoke His name.

But although our enemy—the spirit of error—is the same as that against which the soldiers of Christ have been obliged to contend in every age of the Church's history, the arms employed are different. Of this fact, too, we must take cognizance. As it would be madness in our age of machine guns and high explosives for an army to take to the field provided only with the old-time pike and cross-bow against an enemy equipped with heavy artillery and all the latest munitions of war, so, too, would it be futile for the soldier of the Crucified to hope to achieve victory by the use of arms and methods which, although good in their day, are now no longer available, and, as the methods of combat have changed with the advance of military science, so, too, has the basis of intellectual struggle in the religious and philosophical arena been shifted in order to meet the exigencies of modern science, and in order the more effectually to nullify the assaults of agnosticism, and monism, and scientific atheism.

These statements are of universal application, but apply specially to the Christian ministry, in whose keeping has been placed the precious deposit of the

faith. In referring to this topic in his admirable work, "De Sacerdote," the golden-mouthed prelate of Constantinople, the illustrious St. John Chrysostom, declares that: "We must take all pains that the doctrine of Christ dwell abundantly within us. For the preparations of the enemy's battle are not of one form; the war is in itself various, and waged by divers foes. All use not the same arms, nor conduct their assault on the same plan. He, therefore, who undertakes to fight them all, must understand the arts of each. He must at once be an archer and a slinger, subaltern and commander, soldier on horseback or on foot, equally able to fight in the ship or on the bulwark. For in ordinary warfare each one opposes his adversary after that manner whereunto he hath been trained; but in this conflict it is far otherwise; since, should he who must gain the victory be not intimately acquainted with every separate art, the devil well knows how to take advantage of some unguarded point, and introduce his despoilers to seize and tear the flock. This is not the case where he knows the shepherd to be provided with every acquirement, and aware of his deceits. It behooveth us, therefore, to be prepared on every side,"

Cicero declares that no one can hope to attain to eminence as an orator "unless he shall have acquired the knowledge of all sciences."¹ The same is fre-

²Ac mea quidem sententia, nemo poterit esse omni laude cumulatus orator, nisi erit omnium rerum magnarum atque artium scientiam consequutus. "De Oratore," lib. I.

quently asserted of the lawyer and physician. With far more truth, however, can it be said of the ordained defender of the faith, the priest of the living God. He, indeed, should be versed in all science, sacred and profane, and should be thoroughly familiar with all the wiles and artifices of his antagonist. Clement of Alexandria, that great light of the Christian school of Egypt's noted capital, beautifully illustrates this thought by a striking passage in his "Stromata": "As in agriculture and in medicine, he is considered the best educated who has applied to the greatest variety of sciences, useful for tilling or for curing, so must we consider him most properly educated who makes all things bear upon the truth; who, from geometry, and music, and grammar, and philosophy itself, gathers whatever is useful for the defense of the faith; but the champion who has not trained himself well will surely be despised." "Varied and abundant learning," he insists, "recommends him who proposes the great dogmas of faith to the credit of his hearers, inspiring his disciples with admiration and drawing them toward the truth."

So much importance did Origen attach to a knowledge of profane science that he taught his disciples physics and astronomy before he had them study the Sacred Scriptures. And we all know how eminent in every branch of secular learning were those great lights of the Greek and Latin Churches, St. Basil, St. Gregory of Nyssa, St. Athanasius, St.

Gregory Nazianzen, St. John Chrysostom, St. Ambrose, and St. Augustine, not to mention scores of others. These illustrious Saints and Doctors, to use the words of St. Gregory of Nyssa, "presented learning as a gift to the Church." "In their youth having seized on the spoil of Egypt, and consecrated it to God, they adorned with its wealth the tabernacle of the Church." They considered truth, in the language of St. Augustine, "wherever found, to be the property of Christ's Church." Again observes the Bishop of Hippo, in speaking of the requisites of the theologian: "If they who are called philosophers have said any true things which are conformable to our faith, so far from dreading them, we must take them for our use, as a possession which they unjustly hold." And St. Jerome, in commenting on the words of Ecclesiastes, chap. ii, v. 8: "I heaped together for myself silver and gold and the wealth of kings and provinces," declares that "by the wealth of kings we may understand the doctrines of philosophers and profane sciences, which the ecclesiastic understanding by his diligence, he is able to catch the wise in their own toils."

Those great lights of the Middle Ages, Albertus Magnus and the Angel of the Schools, held the same opinion in respect of the value of mundane science as did Augustine, the Gregories, and their confrères. Both were not only dowered with extraordinary intellectual gifts, but were equally remarkable for their profound knowledge of profane as well as of sacred

learning. Indeed, in the works of Albertus Magnus, which are now being republished by that veteran editor, who has deserved so well of Catholics throughout the world—M. Louis Vivès—we find that much which is often supposed to have been discovered in comparatively recent times was known by the great Dominican and his co-workers over six centuries ago. So great, indeed, is the treasure of knowledge disclosed in the works of this wonderful man that Leo XIII., in referring to them, truly observes that, far from contemning the teachings of antiquity, as so many are wont to do, true philosophy, while seeking new truths, retains the wisdom of the ancients.¹

But we need not go back to the remote past for striking examples of Churchmen who were remarkable for the variety and extent of their attainments in every department of sacred and profane knowledge. We are all familiar with the great work achieved in the cause of religion and science by that distinguished prince of the Church, Nicholas, Cardinal Wiseman. And, not to go beyond the living, had not two other princes of the Church, the venerable Cardinal Archbishop of Tours, Mg. Meignan,² and the erudite Cardinal Gonzalez,³ for the restoration of whose health petitions were offered to God

¹ *Utique videntur hodie nimis multi ponere ingenii laudem in fastidio antiquitatis; sed omnino illa est philosophandi ratio optima, exquirere meditando nova, unaque simul sapientiam veterum non relinquere. "Epistola ad Ludovicum Vives" de Nova Editione Operum B. Alberti Magni.*

² Died January, 1896.

³ Died November, 1894.

at all the altars of Spain, shown what a world of good can be accomplished by men who are learned in the science of the world as well as in the science of the Saints?

It were easy to multiply examples of this kind; to give a long list of the names of learned ecclesiastics, not to speak of eminent members of the Catholic laity, who have shed lasting luster on the cause of religion, as well as on that of true science and true philosophy. My object, however, is not to give a history of what has been achieved by the sons of holy Church in the cause of science and religion, but rather to exhibit by a few telling examples and quotations the great importance which the most illustrious representatives of the Church, and the most successful exponents of her doctrine, have ever attached to a thorough knowledge of profane science in the work of the ministry—in the preaching of the Gospel, as well as in the instruction of youth, and in the preparation of her future Levites for holy orders.

Knowing, then, the influence wielded by modern science in the world of contemporary thought; the character of the warfare in which the defenders of the faith are now, and henceforth will be, engaged; and realizing, too, how necessary it is that the chief custodians of the faith, the priests of God's Church, should be men of varied and profound knowledge; how, especially, they should excel in that knowledge, which, for the nonce, the world sets such store by, I need make no apology for urging the plea that

I now present for the consideration of the International Catholic Scientific Congress.

Under ordinary circumstances I should feel great delicacy in broaching the subject, and should probably hesitate to make it, as it might by some be construed as an impertinent suggestion, or as savoring somewhat of implied dictation to ecclesiastical authority. Nothing, however, could be farther from my mind than any such a sentiment. We are all of us here assembled in the interests of both religion and science, and our object, I take it, is not only to discuss the latest results of scientific research, but also to inquire how science may be made to subserve the cause of religion and extend the sphere of her usefulness. We are here not merely to review the achievements of science since our last meeting, and to investigate the latest scientific theories and speculations, but have met for a nobler and a higher purpose—to offer suggestions, to devise ways and means toward making science subservient to the wants of the Church, and toward enlisting its votaries in an active crusade against the multifarious forms of scientific error which are now so prevalent in every part of Christendom.

All who have the interests of religion at heart—and what loyal son of holy Church has not?—must be of one mind on this subject. There can be no difference of opinion in a matter of such grave import. The question is no longer: What is to be done?—but how to do it. Bishops and superiors of

seminaries the world over are alive to the importance which attaches to a thoroughly educated priesthood—a priesthood versed in natural and physical science, as well as in divinity and metaphysics—but the difficulty which confronts them in most cases is lack of means and lack of subjects. The vineyard is large and the laborers few. They cannot, even with the best will, allow their seminarians to remain at study as long as they would desire. They must content themselves with what is indispensable, and forego what all concede to be eminently desirable. While countless souls are thirsting for the elementary truths of salvation it seems unreasonable, almost criminal, to withhold from them the bread of life in order to give the aspirants to the priesthood an opportunity to perfect themselves in purely secular knowledge.

And then again, it is urged, and with truth, that the vast majority of those who come under the ministrations of the priests are not the wealthy and the learned, but the poor and the illiterate. What these want is not arguments against the false teachings of contemporary scientists, but the instruction and the consolation afforded by the gospel of Christ. The work of God's minister among such people consists in teaching the catechism, explaining the principles of Christian doctrine, in urging them to lead pure, moral lives, rather than in learned disquisitions on the controverted questions of the hour.

All this is true, very true. But we should not forget that there is also a very large number, and the number is daily augmenting, who are interested in the controversies originated by scientific research and discovery; that there are many who are more or less affected by the prevailing scepticism, due in great measure to the teachings of modern science; and that there are also many who are earnestly seeking for light in the darkness of doubt and infidelity, and craving for a knowledge which might be given them, but which is not forthcoming. We close our eyes to the facts if we imagine for a moment that our young men and women are indifferent to current discussions in geology, biology, astronomy, ethnology, and archæology; that they are ignorant of the bearing of these discussions on Scripture and dogma; or that they are always proof against the allurements of false science, when seen in that brilliant and fascinating guise in which she is always made to appear. "The reason," says Cardinal Wiseman, "why infidelity proved so mischievous in France during the last century was, that its emissaries presented it to the acceptance of the people, tricked out with all the tinsel ornaments of a mock science; because they dealt in illustrations and in specious proofs drawn from every branch of literature; because they sweetened the edge of the poisoned cup with all the charms of an elegant style and lively composition; while, unfortunately, they who undertook to confute them, with the exception of Guenée, and perhaps a

few others, dealt in abstract reasoning and mere didactic demonstration."¹

Great, however, as was the danger to the faith during the period indicated, it is greater now because more widespread. The arguments now advanced against religion are more plausible, because urged in the name, and with the authority of, a more advanced science; the poison of error is most subtle and most potent where its existence is least suspected. It is found in books, newspapers, magazines; in works of art, history, literature, philosophy, and religion, as well as science; it is concealed in sermons and public discourses, and oftentimes plays havoc in the simplest social gatherings. Everything that comes under the magic spell of science, and here I mean infidel and agnostic science, is affected by the ubiquitous poison. The whole intellectual atmosphere is polluted with it, and the only saving antidote is a strong, healthy, intelligent faith.

I lay special stress on intelligent faith, because this it is which is often, alas! so sadly lacking. If our people were better instructed in the errors and methods of the dominant teachings of the day, they would not be so exposed as they now are. Forewarned, it is said, is forearmed, but forewarning in the present crisis is not sufficient. We must arm those who look to us for help and guidance with the helmet of faith and the shield of impregnable truth.

¹"On the connection between Science and Revealed Religion." Lecture XII.

We must meet the enemy on their own ground, and assail them in their chosen coigne of vantage. *A priori* reasonings and metaphysical argumentations, which are good enough in their place and with those who are capable of appreciating them, must yield to discussions conducted on a different basis. The geologist, the biologist, the archæologist, and the astronomer, we must meet on their own ground, and turn their own arms against them. This has been done before; it can be done again. We must show to the world that there is, that there can be, nothing in true science, not sciolism or fantastic theory, which is opposed to faith, or to the explicit declarations of the Inspired Record. We must evince that physical science, in the language of Bacon, is, of a truth, "the voice of God revealed in facts—*Vox Dei in rebus revelata*;" that the Council of the Vatican was right when it solemnly declared that "there never can be any conflict between reason and faith—*nulla unquam inter fidem et rationem vera dissensio esse potest*." We must show that the science on which the enemies of the Church are wont to rest their case is sham science, or a science misapplied; that their proofs are but assertions without foundation in fact; that their premises are fallacious, or that their conclusions are false and unwarranted.

Nowhere, indeed, do we meet with such shallowness and superficiality; such pride and pretension; such quibbling and such assertiveness; such declamation and such ignorance of the simplest rules of

logic, as in many of our scientific works designed for general readers. From such a "distortion of facts," says Count Tolstoi in a recent paper, in reply to certain questions put by the German Ethical Society, "arises the curious circumstance that no people have more entangled ideas as to the essence of true knowledge, religion, morality, and existence than men of science," and yet no class of people make greater demands on our faith than these self-same people who would destroy all faith in the Gospel, and banish religion from the world as a relic of an ignorant and superstitious age, but give us nothing in return.

But who are to point out error, to distinguish true from false science, to save the souls of the unwary from the machinations of the enemy, if it be not the bishops and priests of the Church? And how are our future Levites to meet the enemies of religion, those whom the world salutes as the leaders of advanced thought, and the high priests of science, if they be not specially prepared during their course of study in the seminary? Some, it is true, have an opportunity of making serious studies in science before entering the seminary; but they constitute only a small minority. The aspirants to the priesthood must, therefore, acquire their knowledge of science in the seminary, if they acquire it at all. The elementary knowledge which they get in the public schools, or gain by general reading, will serve them but little when they are called upon to discuss

the great questions of science and religion, which in our day are considered to be of such paramount importance. Certain questions of astronomy, geology, paleontology, biology, ethnology, and archæology, they must study not cursorily and superficially, but carefully and profoundly, if they would hope to cope with their adversaries with any hope of success.¹

I do not, however, mean that they should become specialists in these sciences; that they should sacrifice the more important branches of philosophy and theology. Far from it. What I do mean is that they should obtain a good working knowledge of these divers branches of science; that they should thoroughly understand the nature of the objections which are urged in the name of these sciences; that they should adequately realize their bearing on faith and morals, on dogma and Holy Scripture.

By properly directed and systematic effort every student in our seminaries could have these advantages, and that, too, without detriment to the more important branches of his course. I would not be satisfied with mere book knowledge. This is not

¹ In revising this article for the press, I am glad to take occasion to add a sentence from a recent discourse of the eloquent Metropolitan of San Francisco, Archbishop Riordan, who, speaking of the necessity of a higher education for the Catholic priesthood, declares: "We have here in America a great work to perform in the interests of religion and for the good of the people; but we can do nothing unless we can send out into the field men fully equipped by knowledge to meet all the objections which the science of the day may suggest against religion, and to take a leading part themselves in the investigation as well as in the defence of truth."

sufficient. Give the seminarist specimens to examine and instruments to experiment with. Teach him how to observe for himself; how to interrogate Nature in the laboratory, in the quarry, in the field, and in the forest. Such training will be of priceless value to him in after life, whether he be a professor in one of our colleges, a preacher in one of our city pulpits, or a simple curé in a country parish. He will thus be better qualified to instruct those confided to his care, and better prepared to confute the enemies of religion, and more competent to win from danger those who have become weak in the faith, or bring back to the fold those who have strayed from its sacred precincts.

There are, I am aware, difficulties in the way of accomplishing what is here outlined. To equip museums and laboratories requires money, and our seminaries are poor. Our bishops and clergy have so many demands on their charity; so much to do for the poor and the sick, the widow and the orphan, that they consider themselves fortunate in being able to accomplish as much as they do. But although all this be true, the case is not hopeless. By no means. The Church, despite the number of those who would wipe her out of existence, has everywhere many devoted and zealous friends. Let it be known that specimens and apparatus are particularly desirable in order to carry on the work of ecclesiastical instruction, and I have faith enough in the good will and co-operation of Catholics to believe that

they will come to the rescue. I can speak from experience in this matter. For more than twenty years I have had charge of the scientific department of Notre Dame University, and I am, therefore, in a position to testify, from experience, what may be expected from the friends of religion and education when they once become interested in such an important matter as the one we are now considering.

Of course, I should count much on the co-operation of the members of this Congress. If they collectively and individually give the matter their endorsement, and engage not only to encourage the good work themselves, but also to interest their friends in it, we shall, I promise you, soon behold results as surprising as they will be gratifying.

Something, it is true, has been done already, but much more remains to be accomplished. Much has been done, even by distinguished men here present, both lay and clerical, to aid Catholics in their warfare against false science and false philosophy, and for this all are duly grateful. Works of acknowledged value, from small handbooks to exhaustive treatises, on various controverted questions of science and religion have been published from time to time, and numerous excellent magazines, in America and Europe, deal learnedly and effectively with the questions of the hour. Indeed, I need not go beyond the limits of this fair city of Brussels to find a publication, the *Revue des Questions Scientifiques*, which is an honor to religion as well as to science, and of

which the Catholic world may be justly proud. As a thorough, accurate expositor of the most advanced thought of the day in every department of science, it has no superior in any language. God reward with an exceeding great reward that noble soul, Father Carbonnelle, S. J., now gone from our midst, who so auspiciously inaugurated it, and bless a thousandfold the labors of those in whose hands the great undertaking is now entrusted. May they live to see realized all their fondest anticipations, and to know that the *Revue des Questions Scientifiques* is prized in all lands according to its transcendent merits and the unquestioned good it is destined to achieve.

Another reason why we should devote special attention to the study of science, why the youth in our ecclesiastical seminaries should excel in science, is that the Holy Father wishes it, because our enemies fear such study on our part as the greatest calamity which could befall the unholy cause to which they are committed.

The learned Pontiff, now gloriously reigning, while yet Bishop of Perugia, gave an adumbration of that policy respecting the study and advancement of science which he has so consistently and so successfully followed since his accession to the Chair of Peter. Time and again since he assumed the tiara he has spoken of the advantages accruing to religion by the study of science. But in no instances, probably, has he given better evidence of his love

of science, and of his ardent desire to see it specially cultivated in our colleges and seminaries, than in his two admirable encyclicals, the "Æterni Patris," in which he recommends the study of the philosophy of St. Thomas, and the "Providentissimus Deus," urging a special and profound study of the Sacred Scriptures. His observations in the latter encyclical are so weighty, and bear so directly on the contention I have been making, that you will, I know, pardon me, if I quote somewhat *in extenso*. In referring to the value of a knowledge of natural science to the student of Scripture, the illustrious Pontiff declares: "It is necessary to meet the attacks of those who, abusing their knowledge of physical science, investigate the sacred books with minute care in order that they may expose the ignorance displayed on this subject by the authors, and may vilify their writings. And since these contentions are concerned with sensible objects, they are all the more dangerous, falling, as they do, into the hands of the masses, and especially those of youth, who are fond of literature, and who, when they have once lost their reverence for divine revelation in any of its parts, will easily give up all belief in the whole. It is beyond doubt that the more suitable natural science is, if rightly taught, for ensuring the perception of the glory of the great Maker stamped upon creation, the more effectually it may be employed, if instilled in a wrong way into the minds of the young, to uproot the first principles of sound philosophy, and

corrupt morals. Wherefore a knowledge of natural science will afford valuable assistance to the teacher of Sacred Scripture by enabling him the more readily to expose and refute the fallacies of this kind also, which are brought forward against the authority of the sacred books. Indeed, no real difference can arise between the theologian and the physical scientist, so long as each keeps to his own province, both, in accordance with the warning of St. Augustine, being on their guard against 'making any rash statement or asserting as known what is unknown.'"

Farther on, he observes, and with truth, that "to strive fully to establish the sanctity of the Bible with every aid from the deeper sciences is far more than can be justly expected from the skill of interpreters and theologians alone. It is to be desired also that those amongst Catholics who have attained any reputation in external sciences should join and assist in this work. As in the past, ability of this kind has never been, so it is not now, thank God, wanting to the Church; and it is to be hoped that it will increase for the benefit of faith. For we ought to consider nothing of greater importance than that the faith should have more numerous and more powerful defenders, and that they should understand the tactics of her adversaries; and nothing could be more effective in impressing upon the masses the duty of accepting the truth than to see it publicly professed by those who have gained distinction in

any particular walk of life. Nay, the ill-will of disparagers would quickly cease, or at least they would not dare so boldly to accuse faith of being the enemy of science, if they saw the highest honor and reverence paid to it by distinguished scientific men."

But the most forcible, and at the same time epigrammatic, statement of Leo XIII.'s views on the study of science, is to be found in his letter to Mgr. Goossens, the Cardinal Archbishop of Mechlin, regarding the establishment of a new chair of philosophy in the University of Louvain. His words are: "Since the Church is falsely accused of detesting science and of desiring to spread the darkness of ignorance, it behooves Catholics to make it manifest that they do not condemn the lights of science, but covet them earnestly, because they do not subvert the dogmas of faith, but wonderfully illustrate them, inasmuch as both the one and the other have their origin in the same God, the author of faith and the Creator of the world."¹

I have said that the enemies of the Church dread a learned priesthood, especially a priesthood which is profoundly versed in profane science. It is true. They dread nothing more, and declare their appre-

¹ Quum porro Ecclesia eo falso nomine in crimen vocetur, quasi perosa scientiarum lucem ignorantiae tenebras studeat offundere, eo conniti oportet Catholicos homines ut præ se ferant palam, se veræ scientiæ lumina haud fastidire sed appetere, quippe quæ fidei dogmata non evertunt sed mirifice illustrent, quum utraque ab uno dimanent auctore fidei et rerum mundarum Conditor Deo.

hension by words and deeds. One of the first acts of Julian the Apostate after he had made shipwreck of the faith was to issue "a decree whereby Christians were debarred from attending public schools and acquiring science."

Professor Huxley, the noted hierophant of agnosticism, makes no secret in declaring what he regards as the one great enemy of science from his point of view. In his "Lay Sermons" in an interesting chapter on "Scientific Education" he compares the Protestant with the Catholic clergy, and referring to the former he says they "are at present divisible into three sections; an immense body who are ignorant and speak out; a small proportion who know and are silent; and a minute minority who know and who speak according to their knowledge. By the clergy I mean especially the Protestant clergy. Our great antagonist, I speak as a man of science, is the Roman Catholic Church—the one great spiritual organization which is able to resist, and must, as a matter of life and death, resist the progress of science and modern civilization, manages her affairs much better.

"It was my fortune some time ago to pay a visit to one of the most important of the institutions in which the clergy of the Roman Catholic Church in these islands are trained; and it seemed to me that the difference between these men and the comfortable champions of Anglicanism and dissent, was comparable to the difference between our gallant

volunteers and the trained veterans of Napoleon's Old Guard."

Coming as they do, from the high-priest of agnosticism these words are significant and deserve pondering. They declare that the enemies of the Church to-day, as in the past, regard her representatives as the sole antagonist worthy their steel. The various Protestant sects give them little or no concern. From Protestant ministers agnostic and infidel scientists have nothing to apprehend; they have a free field and nothing to impede their progress. It is the Catholic priesthood which they fear, which they have always feared, as they are the only body of men competent to stem the torrent of error which now threatens to overwhelm the land. Strong in the certain truths of a divine faith, endowed with the courage which comes from the spirit of knowledge and fortitude, they form a solid phalanx against the advance of scientific, as well as of religious, error; and constitute a bulwark for the faith which is as impenetrable as a wall "of tenfold adamant."

But, be it remembered, the priesthood to which Huxley refers is an educated priesthood; a priesthood specially trained to combat the errors of the day; errors which are advanced in the name of what the British scientist euphemistically designates "scientific thought." He, then, supports my plea, and his words, just quoted, makes for its validity in the most eloquent manner possible. It is our enemies who not infrequently tell us the most wholesome

truths, and if we are wise we will profit by them as well as if they came from the most tried and trusted of friends.

I could wish to enter for our colleges a plea similar to the one I have just been making in behalf of ecclesiastical seminaries, but it does not come within the scope of the present paper. For in good sooth, let us be honest with ourselves, we must admit that, with few notable exceptions — grand, historic old Louvain is one of them — the scientific standing of our Catholic colleges is not what it should be.

There are, I know, serious difficulties in the way of raising them to the plane on which we would desire to see them, but these difficulties are not insurmountable. If we were to devote as much time to science as we do to classics, we could exhibit better results. It is not my purpose to decry classics: by no means; but rather to insist on the truth of the old saying, "*Hæc facere et illa non omittere.*" All who are conversant with the facts in the case will, I think, confess that we are warranted in claiming for science a greater consideration than it has received in our Catholic schools and colleges either in Europe or America. *Emendemus in melius quod ignoranter peccavimus.* Yes, by all means, let us improve where betterment is so obviously demanded.

But although an improvement in the status of science in our schools and colleges is a "consummation devoutly to be wished," I am, for the present.

at least, content to rest my case with a consideration of the necessity, if not of the ways and means, of imparting a more thorough knowledge of science in our ecclesiastical seminaries. The hope of the Church in the future lies, under God, in the thorough education of the youth who are now preparing for the sacred ministry; and, in the present needs of religion, their education cannot be considered complete unless they have at least a good working knowledge of the natural and physical sciences.

The question, however, may be asked, Why do I bring the consideration of this subject before the International Catholic Scientific Congress? Might it not more properly be discussed in an assemblage of bishops in provincial or plenary councils? Doubtless; but there are countless other things which, in these days of doubt and unrest, imperatively demand the attention of the hierarchy. And, far from finding it an impertinence on our part to discuss the topic in such an assemblage as the one I have now the honor to address, the prelates of the Church, who rejoice in every good work, by whomsoever inaugurated or achieved, will, I am sure, be only too glad to know that this Congress is interested in the matter, and has at heart what they themselves prize more than aught else—the education and welfare of those who are to be the future shepherds of Christ's flock. They will be gratified to learn that they, in so important a work, can count on the sympathy and coöperation of such a distin-

guished body of men, and have the benefit of their wisdom and science.

In union, it is said, is strength. I question, however, if any of us fully realize what may be accomplished in the direction indicated by the concerted action of such a body as the International Catholic Scientific Congress. When we call to mind what has been effected by organizations which were numerically much inferior to ours, but which were actuated by zeal and an insatiable love of learning, it would be almost rash to assign limits to what the combined efforts of the members of this Congress can achieve when they set about an enterprise in dead earnest. The Christian School of Alexandria, of which Origen and Clement were such shining lights; the schools of Syria, and Antioch, and Cæsarea, rendered so famous by the achievements of Saints Ephrem, Chrysostom, Basil, Gregory of Nyssa and their collaborators, are ample evidence, if any were required, of what can be accomplished when faith and science are dominated by zeal for truth and love of Holy Church.

The attribution of omnipotence to this Congress is, of course, something quite foreign to my mind. I do not expect of it impossibilities, but I do look to it for great things in matters both of science and religion. And in this hope, I am sure, there is among those who know what the Congress has already effected during its short existence but one opinion. In these days when steam and electricity have prac-

tically annihilated time and space; when the printing press brings within the reach of all, even the poorest, the latest acquisition of science, and renders possible a diffusion of knowledge among the masses, that was undreamed of a few decades ago, and which our forefathers, if any one had predicted what has actually come to pass, would have pronounced Utopian, if not impossible; in these days of inventions and marvels, we may, I say, hope, and hope reasonably, to achieve what no one but a visionary, a few generations ago, would have attempted, or deemed even feasible.

In America we have carefully watched the career of this organization ever since its inception. We have been interested in its proceedings, and have scanned its published reports with eagerness and pride. We have all along recognized its power and influence for good, and from the bottom of our hearts we have thanked God for giving to the Church an instrument so potent and so universal in its sphere of action. We have noted with pleasure and gratitude the interest which the Father of the Faithful, and the Princes of the Church, the members of the episcopate, and the most distinguished representatives of science, have displayed in the meetings of the Congress, and have felt that a bright day is dawning both for science and for religion.

Let us then be up and doing. Let us realize the power of the instrument which Providence has

placed in our hands. We have before us the traditions of Saints and Doctors; the teachings of holy and learned Pontiffs; the appeals of countless souls invoking our assistance; the declared fear of our enemies that we will press into the service of religion the one agency whose power they recognize, and shall we hesitate as to what we shall do? Ah! no. The situation is too critical; there is too much at stake; the issues are too far-reaching, embracing not only time but eternity, to permit any delay or vacillation on our part.

The work will be arduous, indeed, but it is bound, in the very nature of things, to be prolific in mighty and far-reaching results. Lay and cleric, we can all of us join in the undertaking, and work hand in hand for a common purpose; for the furtherance of a cause in which we are, or should be, equally concerned, the salvation of souls, and the glorification of the Church militant. To those of us, on whose shoulders have been placed the burdens and responsibilities of the sacred ministry, can be addressed individually the words of the poet, Browning:

“God did anoint thee with His odorous oil,

To wrestle not to reign.”

As to our confrères of the laity, they should not forget the words of another bard who tells them:

“Not a truth has to art or to science been given,

But brows have ached for it, and souls toiled and striven.”

And, furthermore, and finally, we should, all and sundry, bring home to ourselves the full significance of Longfellow's beautiful lines on "The Ladder of St. Augustine":

"The heights by great men reached and kept,
Were not attained by sudden flight,
But they, while their companions slept,
Were toiling upward in the night."

CHAPTER VII.

THE FORERUNNER AND RIVAL OF PASTEUR.

ON the 8th of January, 1894, the University of Louvain lost one of her most distinguished sons, and the world of science was called upon to mourn one of its brightest ornaments. On that day the illustrious zoölogist and paleontologist, Pierre Joseph Van Beneden, laid down the burden of life, at the ripe old age of eighty-five, leaving behind him a record that even the greatest of the world's scientists might envy.

To say that Louvain lost in Van Beneden one of her most distinguished sons is saying much. In the course of the five hundred years of her existence—during all of which period she was one of the great beacon-lights of Europe—she has seen in her lecture-halls many who now occupy conspicuous positions in the temple of fame. It were, indeed, a difficult matter to recount all her triumphs, or enumerate the long list of those who have fondly saluted her as *Alma Mater*, and who, either as students or as professors, have added unfading luster to her escutcheon, and contributed, in many ways, to make her name glorious among the great universities of

the world. Here it was that Justus Lipsius, the noted humanist, and the immortal commentator of Seneca and Tacitus studied and taught; here it was that Bellarmine, the prince of polemical theologians, lectured to delighted audiences; here it was that Vives, who, with Erasmus and Budæus, constituted the triumvirate of the republic of letters of the sixteenth century, lectured on polite literature; and here it was that Adrien van Roomen—Adrianus Romanus—one of the greatest mathematicians of his age, while professor of mathematics, invented modern or symbolical algebra. It was here that Van Helmont, the illustrious chemist, the discoverer of the third kind of matter, gas, a word invented by him, sought knowledge; it was here that Mercator, the first one to make maps and charts by a projection of the surface of the earth *in plano* completed his studies and prepared himself for the work in which he subsequently won such renown; it was here, too, that Jean Pierre Minkelers made use of coal-gas to light his lecture-rooms, full eight years before it was introduced in Cornwall by Murdock, its reputed inventor. Here, where for five centuries art, science, and literature flourished; where the most distinguished professors of Europe lectured; where there were as many as six thousand students at one time; where, from the year of its foundation, in 1429, until the present day, Louvain has kept pace with the great Universities of Paris, Oxford, Heidelberg, Vienna, Bologna, and Rome;

here it was that Van Beneden, the latest of a long list of intellectual giants, won the admiration of his thousands of pupils, and the plaudits of the world.

It would be impossible in a brief chapter adequately to treat of Van Beneden's life-work. This would require a large volume, and it is to be hoped, in the interest of science and that of the youth of our time, for whom the late savant was so noble and helpful an example, that such a work will not be long in forthcoming. The most I can seek to accomplish in the limited space at my disposal is to indicate a few of the more remarkable of the late scientist's achievements, and touch briefly on his character as a man and as a son of the Church.

Like Ampère, Fresnel, Faraday, Pasteur, and others who have achieved distinction by their conquests in the domain of Nature, Van Beneden was pre-eminently a self-made man. Indeed, one of the most striking lessons of his long and successful career, the one which the youths of our age should most take to heart, is that which is taught by the Flemish professor's untiring industry and perseverance. He was credited with genius, but with him, as with all who have earned distinction in science, genius meant hard, continuous work.

In reply to an address read him in 1877, on the occasion of his fortieth anniversary as professor, he said: "There is a word which I can not admit unless its meaning is defined. That word is *genius*. If genius is but a synonym for perseverance, we are at

one. I need not go beyond Linnæus, the great naturalist of the last century, who has given two precepts which bear directly on this point. These precepts contain the whole secret of the successful naturalist. The first is, never to let a day pass without having done something, *nulla die sine linea*; the second is, to have method in work, *ordo rerum animæ*. I have endeavored to follow these prescriptions of the philosophical naturalist, and I owe to them, without doubt, the flattering manifestation of which I am to-day the object."

Pierre Joseph Van Beneden was born in the city of Mechlin, the 15th of December, 1809, and was, therefore, at the time of his death, in his eighty-fifth year. He always entertained the deepest affection for his natal city, and was ever proud to call himself a *Malinois*. This affection was fully reciprocated by his fellow-townsmen, as was evidenced in a most striking manner on divers occasions. They had made and placed in the city hall a handsome bust of the illustrious scientist, and on the occasion of the demonstration in honor of the fiftieth anniversary of his professorship at Louvain, they testified to their admiration and love by naming one of the most beautiful thoroughfares of the city *Avenue Van Beneden*.

The future professor of science made his humanities in the archiepiscopal college of Mechlin. Here he met, among his professors, the distinguished ecclesiastic, who subsequently became rector of

Louvain, and who signalized the beginning of his administration by giving his former pupil the chair of zoölogy and comparative anatomy, which he filled with such *éclat* for nearly sixty years.

After leaving college he entered, in his native city, the shop of an apothecary by the name of Stoffels. This gentleman, who subsequently became known to the world by the reflected light of his talented assistant, had a small collection of shells and minerals, which at once excited the interest of young Van Beneden. It was, indeed, it may be said, the examination of this collection that gave him his taste for science, and determined his future career. It inspired him with a love of Nature, and from that time forth we find him devoting all his leisure moments to an enthusiastic study of the manifold forms of the organic world.

At this period of his life, however, his country was in a very unsettled condition, and circumstances were anything but favorable to the prosecution of serious studies of any kind. His country was engaged in a sanguinary war with Holland, and Van Beneden felt that he owed it to the land of his birth to take up arms in her defense. But even as a soldier he did not forget his love for Nature and her marvels. "I always remember," he tells us himself, "that while fighting under the walls of Antwerp I more than once surprised myself with a fossil-shell in one hand and a cartridge in the other."

After leaving the army, Van Beneden prepared

himself for the degree of Doctor of Medicine, and on the 19th of July, 1832, passed the requisite examination with great distinction. His next thought was to spend a few months in the celebrated museums of Paris. Here he met a number of distinguished scientific men, with whom he formed relations of friendship that proved of countless value to him. Among others, he met one Baron de Ferussac, a well-known conchologist of the time, who secured for his young Flemish friend a bourse from the Belgian government, which enabled Van Beneden to prosecute his researches for two years longer than would have been possible if he had been unaided.

In April, 1836, he was tendered, and accepted, the chair of zoölogy and comparative anatomy in Belgium's greatest seat of learning, the University of Louvain, a position which he held uninterruptedly until the date of his death.

From this beginning of his professorial duties, Van Beneden's life-work began in earnest. He soon made a reputation for himself as a professor of more than ordinary ability, and it was not long before his lecture-room was filled with enthusiastic and admiring students. In addition to having a profound knowledge of the subject-matter of his discourses, he had a ready command of language, a pleasing delivery, and a faculty for illustrating the most dry and abstruse points which made his lectures intellectual treats, instead of distasteful and perfunctory tasks. Besides being fluent of speech, he was a skillful

draughtsman, and was able, by a few cleverly-executed lines on a blackboard, to elucidate without difficulty even the greatest complications of form and structure.

When not occupied in the lecture-room, he was busily engaged in the laboratory, or in investigating the life-histories of the divers forms of animals in their own peculiar habitats. He did not, by any means, disdain the specimens of museums, but he always contended that far more was to be learned by studying the living subject. In the earlier days of his scientific career the conveniences of travel were not so great as they are at present, but this did not deter him from making extended journeys in search of knowledge. To secure accurate information regarding the fauna of Europe, he traveled afoot, with staff in hand and knapsack on his back, through France, Germany, Switzerland, Austria, Italy, Sweden, and Norway. He carefully explored Vesuvius, *Ætna*, and the Alps, as well as the coast-line of the Atlantic and the Mediterranean.

But he was not contented with studying the fauna of the countries visited. He investigated their geological and paleontological features as well. As to the fauna, living and extinct, of his own country, he knew it intimately from France to Holland, and from Luxemburg to the North Sea. There was not a nook or corner that he did not explore; not a river or stream with whose denizens he was not familiar.

In order to become thoroughly acquainted with the multifold forms of marine life which frequented the Belgian coast, it was Van Beneden's wont to go out with the fishermen while engaged in their avocation, or to hire boats from them, and explore at his leisure.

He was always much interested in those monsters of the deep, the *cetacea*, and he did not hesitate to brave the dangers of a whaling expedition to the North Cape in order to study to the best advantage the nature and habits of this singular order. The results of these expeditions have been embalmed in a series of monographs which are regarded not only as authoritative on the matters treated, but also as models of accurate and pellucid description.

In 1843 he established at Ostend, at his own expense, a marine laboratory, which was one of the first, if not the first, of the kind ever organized. This was the prototype of the numerous laboratories of a similar character which all the governments of the civilized world have since established in the interests of science and commerce. In his laboratory Van Beneden, who had already become famous, was visited by the ablest naturalists of the age. Among those who went there for purposes of study and observation, were Liebig, Max Schultze, Ehrenberg, Johann Müller, the great anatomist of Berlin, and De Quatrefages, the distinguished professor in the Museum of Natural History at Paris.

Shortly after the establishment of the laboratory

at Ostend, Van Beneden began his epoch-making experiments on intestinal worms. So great was his success in this line of work, so thorough were his observations, and so conclusive were his inductions, that he may, with truth, be called the father of helminthology. He correlated and integrated the scattered observations of his predecessors, and brought order out of chaos; and for the first time the interesting and important science of helminthology was put on a logical basis.

From the time of Aristotle it had generally been believed that certain animals, especially of the lower forms, came into existence without the mediation of antecedent life. Spontaneous generation was regarded not only as possible, but accepted as a fact, which was evinced by countless phenomena that were regarded as otherwise inexplicable. It was an axiom of science "that the corruption of one thing was the birth of another," and hence the universally accepted opinion that certain worms and insects were generated by the putrefaction of animal matter.

The first one to attempt an experimental refutation of abiogenesis, or spontaneous generation, was Francesco Redi, an Italian naturalist who flourished two centuries ago. He was in a measure successful so far as the generation of maggots from putrefying flesh was concerned, but his experiments did not cover the difficulties that were founded on the existence of certain animalculæ, whose origin was then enveloped in mystery. True, the application

of the microscope to the study of the lower forms of life, by such skilful observers as Leeuwenhock, Réaumur, and Swammerdam did much to corroborate the conclusions of Redi, but the case against spontaneous generation was far from being definitely settled. It found supporters in such distinguished scientists as Buffon and Needham, and for a while it appeared as if the difficulty, instead of being solved, had been but removed to the domain of microscopic life. Notwithstanding the searching criticism to which the celebrated Abbate Spallanzani submitted the doctrines of Buffon and Needham, and the ingenious experiments which he devised to overthrow their conclusions, spontaneous generation, with the great majority of scientific men, continued to be accepted as a fact which could not be gainsaid.

It was thus that matters stood when Van Beneden, in 1848, began his famous investigations on intestinal worms. Various attempts had previously been made to account for the origin of these parasites, but without success. In ignorance, therefore, of their nature and origin, the naturalists of the day were content to admit that at least these mysterious creatures came into existence without parents, and that in their case life was not the result of antecedent life.

For two long years Van Beneden worked assiduously on the problem before him, and at the end of this period he was enabled to announce authoritatively that the dictum *omne vivum ex vivo*, that

there is no life without antecedent life, holds good for animal parasites of all kinds as well as for the higher forms of life; that cestodes, nematodes, trematodes, and other parasitic worms have parents as well as the subjects they inhabit.

A few decades before Van Beneden had begun his researches, the eminent naturalist, Lamarck, had written, "We are now authorized to believe that there are *innate* worms, or such as are produced by spontaneous generation, and that these are modified from time to time; this is, at present, the opinion of the most enlightened observers." The Louvain professor not only completely disproved this view, but he effectually banished from the domain of science an error which had been dominant in natural history and philosophy for fully twenty-five centuries. Subsequently, indeed, it attempted to regain its prestige under cover of microbes, bacteria, and other infinitesimal forms of life, but its efforts were at once nullified by the brilliant experiments of Pasteur, who, at the conclusion of his magnificent work, was able to announce positively that spontaneous generation is a chimera. His conclusions, however, were but a corroboration of those reached several years before by his great Belgian rival, and although the experiments by which Pasteur arrived at his results must be ranked among the most ingenious and delicate ever devised, nevertheless, the splendor of his achievements in no wise dims the lustre of the work accomplished by the eminent biologist of Louvain.

For these important and far-reaching researches the Institut de France awarded Van Beneden the *Grand Prix des Sciences Physiques*. As was to be expected, the overthrow of such long cherished opinions caused a profound sensation. Naturalists the world over hastened to repeat the experiments of the Flemish savant, and to detect, if possible, a flaw in his demonstration. In Germany, especially, where Van Beneden's work excited the deepest interest, Walden, Von Siebold, and Küchenmeister submitted his researches to the most rigorous examination, but were at length forced to confess, not only that his conclusions were legitimate, but also that his position was impregnable.

This one achievement, the exploding of an error which had endured from the days of Aristotle, was enough to render Van Beneden immortal, enough to secure immortality for any man. But great as it was, this was but one of his triumphs.

In connection with his researches on intestinal worms, he was able not only to disprove the doctrine of spontaneous generation, but also to shed light on the genealogy and habits of these strange forms of life. For it was while engaged in these researches that he made his startling discovery of the metamorphosis and transmigration of these remarkable creatures. So wonderful, indeed, were these metamorphoses and transmigrations that their discoverer was truly justified in asserting, that

"they much surpass in reality the most brilliant and extravagant fictions of the poets."

A large number of entozoa, it is known, occur in their immature stage—have their *crèche*, as Van Beneden phrases it—in the tissues or organs of such forms of life as constitute the food of their ultimate hosts. Thus the cat obtains a certain species of *tænia*, tape worm, from the mouse; the dog derives another from the sheep and the rabbit; while the well-known *tænia solium*, in the course of its migrations, passes from swine to man.

Van Beneden's great merit lies not only in his demonstration of the fact of metamorphosis and transmigration of the cestodea, to which the divers species of *tænia* belong; not merely in his proof that "the cysticercus [larval *tænia*] of the pig, when introduced into man, becomes a *tænia* with as great certainty as the seed of a carrot will produce this plant if sown in suitable soil," but in his demonstration that "cestode worms must *necessarily*"—I use his own words—"pass from one animal to another to complete the phases of their evolution."

When this wonderful discovery was announced in the French Academy, Flourens, its perpetual secretary, pronounced it "a romance." Now, however, these transmutations and metamorphoses are so well known and so universally admitted, that, as their discoverer himself remarked some years ago, "the starting point of the inquiry has been so en-

tirely forgotten that the honor of the discovery has frequently been attributed to fellow-workers, who had no knowledge of it till the demonstration had been completed, and the new interpretation generally accepted.

The significance and importance of Van Beneden's researches were not long in being recognized. The ætiology and prophylaxis of a large class of diseases, which previously had been impossible, were now placed on a scientific basis. With the explosion of the doctrine of spontaneous generation were banished forever from the science of medicine such silly notions, so long current, as that certain diseases are due to "a vitiated condition of the humors," to "a deterioration of the parenchyma," or to "a verminous temperament." The cause and the nature of such diseases were at last known, and if their diagnosis was not always easy, their treatment, at least, as well as their cure, became not only practicable, but also, in many cases, as simple as it was effective.

Until the conclusion of the researches by Van Beneden on entozoa, and of those by Pasteur on microbes, medicine was at best but an art based on empiricism. Now, thanks to the marvelous discoveries of these investigators, medicine, as well as surgery, is a science; and the physician and surgeon, instead of working in the dark as hitherto, and fighting against invisible foes, whose very existence was formerly ignored, are now able to accomplish results

and effect cures which before were impossible. Diseases that a few decades ago created such havoc among the flocks and herds of the husbandman, and exacted such heavy tributes from afflicted humanity, are now put within the power of the curative art, and the plague, far from exciting the horror it formerly caused, is no longer more a source of danger than any other undesirable visitant which can be checked or put under control. And in the bright galaxy of men of science, two luminaries will ever be conspicuous, two names will always be pronounced with benediction by a grateful race, and these are the names of Van Beneden and Pasteur.

Space will not permit me to make more than a passing allusion to Van Beneden's other labors. Among his most notable researches, after the ones just indicated, are those on the *cetacea*. His work and discoveries in the fossiliferous strata of Antwerp are not surpassed in their extent and brilliancy, even by the famous investigations of Cuvier in the Paris basin, or by those of Hugh Miller in the Old Red Sandstone. It is saying much, but it is the truth, when it is declared that the Belgian naturalist was the rival, not only of Pasteur, the greatest of microbists, but also that he was the rival of Cuvier, the most illustrious of comparative anatomists. The inspection of his publications, nearly three hundred of them, all told, many of which are masterpieces of clear and exhaustive treatment, and the magnificent work he has done in paleontological classifi-

cation and reconstruction, as exhibited in the museums of Brussels and Louvain, which were almost entirely his creations, are sufficient evidence of the truth of these statements, exaggerated as they may appear to one who is not acquainted with the facts of the case.

Van Beneden's principal researches, strange as it may appear, were confined to the two extremes of animal creation, to the minute entozoa, and to the giant cetaceans, living and fossil. But whether studying the marvelous forms of microscopic life, or the leviathans of recent and past ages, he was ever the master, and exhibited in all his work a keenness of perception, a comprehensiveness of view, a power of analysis and synthesis, which have been possessed by few in such an eminent degree. He combined the patience and accuracy of Johann Müller with the industry and faculty of generalization of Cuvier, and the profound and extensive knowledge of the elder Agassiz. Certain departments of the fauna of the modern and ancient worlds he had made a life-long study. Nothing escaped his quick eye or eluded the grasp of his searching intellect. When his pen was not in his hand, he was at work with his scalpel, his microscope, or his trawl. He labored early and late, but he labored intelligently and systematically. This, aside from his talent for observation and experiment, a talent which was carefully cultivated by long practice, enabled him to accomplish what it seems would

have required the time and undivided energies of several men, instead of one, unaided and alone.

It is only when we contrast Van Beneden's work with that which has been accomplished by some of his contemporaries, and which has attained much greater notoriety, that we can fully realize what a genuine student of Nature he was, and how securely we can follow him as an interpreter of Nature's processes and Nature's laws. We have but to compare his charming little work, "Animal Parasites and Messmates"—one of the *International Scientific Series*, published by the Appletons—with Hæckel's fanciful "Evolution of Man" to appreciate the difference between the two naturalists, and to realize the antithesis between the two schools of thought of which they may be considered the exponents. The Professor of Louvain writes with a sure and unerring hand. He makes no statements which he has not either verified himself, or which have not been verified by others. Like the illustrious paleontologist, Barrande, he speaks of what he has seen, and not of what he has imagined, or of what his theory would demand. The Jena naturalist, on the contrary, is dogmatic, speculative, nebulous; one who not infrequently distorts facts to suit his theory, rather than subject his theory to the inexorable requirements of fact; one who is a monist, or atheistic evolutionist first, and an unbiassed, if he is ever unbiassed, student of Nature afterwards. One rises from the reading of Van Beneden's delightful book,

pleased and refreshed, and feeling that he has been admitted into the *arcana* of Nature by one of her favorite initiates as well as by one of her best qualified exponents; whilst the perusal of Hæckel's production engenders lassitude, confusion, dissatisfaction, and often disgust.

Like Kepler, Newton, Linnæus, Louis Agassiz, Leverrier, and others in the fore-front of the world's great men of science, Van Beneden was a man of deep religious convictions, and real, unaffected piety. He loved to see the handiwork of God in the visible world, and to trace the operations of His providence in the development and conservation of His creatures. He was born and raised a Roman Catholic, and to the day of his death he continued a devoted and consistent member of the faith of his fathers.

"In that great drama which we call Nature," he tells us in the introduction to his "Animal Parasites and Messmates," "each animal plays his special part, and He who has adjusted and regulated everything in its due order and proportion, watches with as much care over the preservation of the most repulsive insect, as over the brood of the most brilliant bird. Each, as it comes into the world, thoroughly knows its part, and plays it the better because it is more free to obey the dictates of its instinct. There presides over this great drama of life, a law as harmonious as that which regulates the movements of the heavenly bodies; and if death carries off from

the scene every hour myriads of living creatures, each hour causes new legions to rise up in order to replace them. It is a whirlwind of being, a chain without end."

He was a firm believer in the "Grand Ideas," of Plato, and, with Cuvier and Agassiz, he contended that "the statuary who tempers the clay from which to make his model has already conceived in his mind the statue which he is about to produce. Thus it is with the Supreme Artist. His plan from all eternity is present to His thought. He will execute the work in one day, or in a thousand ages. Time is nothing to Him, the work is conceived, it is created, and each of its parts is only the realization of the creative thought and its predetermined development in time and space.

"The more we advance in the study of Nature," he quotes approvingly from Oswald Heer, "the more profound becomes our conviction, that belief in an Almighty Creator and a Divine Wisdom, who has created the heavens and the earth according to an eternal and preconceived plan, can alone resolve the enigmas of Nature, as well as those of human life, Let us still erect statues to men who have been useful to their fellow-creatures, and have distinguished themselves by their genius, but let us not forget what we owe to Him who has placed such marvels in a grain of sand, a word in every drop of water."

As Van Beneden saw it, there was no conflict between science and religion, nor was there, accord-

ing to his view, any conflict possible. The word of God, as contained in the Book of Books, could not be at variance with the testimony of the rocks, or the unequivocal teachings of animate nature. Certain scientific theories might be opposed to individual opinions, but science in contradiction to revelation, never.

Among those who are capable of appreciating the bearing and value of the great Belgian's work, few among contemporary scientists stood so high as Van Beneden. That his name is not more familiar to the public at large is due to the rigidly scientific character of his work, and to the fact that it was limited mostly to subjects in which only devotees of science and medicine are directly interested. But as an evidence of the esteem in which he was held by the world of science, it is sufficient to state that the chief learned societies of both Europe and America vied with one another in showing him honor. From Moscow to San Francisco, from Edinburgh to far-off, antipodal Wellington, scientific associations and universities recognized his ability and the magnitude of his discoveries, by enrolling him among their members, and by conferring upon him the highest degrees in their gift. He was one of the few corresponding members of the French Institute—a distinction as coveted as it is rare. But more than this: Princes and governments emulated societies and universities in honoring the "grand old man of Louvain," and in bestowing upon him their most

cherished orders and insignia. Dom Pedro, of Brazil, who entertained a genuine affection for the illustrious savant, was wont to call him *cher maître*, and his own sovereign held him in such high esteem that he conferred upon him the highest degree of the nation's order of knighthood, the order of Leopold.

Well, then, could Louvain's faculty exclaim, by the mouth of its spokesman, Mgr. Abbeloos, on the occasion of the memorial services held a few days after the great scientist's demise: "*Cecidit corona capitis nostri*"—we have lost our glory and our crown. He was indeed the glory of the distinguished body with which he was so long associated, and it will be long before Louvain, and long before Belgium, shall look upon his like again.

CHAPTER VIII.

LOUIS PASTEUR AND HIS LIFE-WORK.

AMONG the men of science whom it has been my good fortune to meet, no one more nearly approaches my ideal of the true savant than the eminent chemist and biologist, Louis Pasteur. And among the various institutions that I have visited, which are specially devoted to the prosecution of science, or are the outgrowth of scientific research, no one has ever possessed for me a greater interest than the famous Institut Pasteur, in Paris. This noble foundation, a monument to the genius of Pasteur, and a witness to the liberality and the intelligent and humane spirit of the French government, is the best illustration, if any were now needed, of the value of experimental science, and of the practical results which accrue from the quiet and patient investigations that are being carried on in so many of our modern laboratories.

For the past forty years the name of Pasteur has been a household word throughout the civilized world. For ages to come his memory will be held in benediction, and France will point to him with pride as one of the most illustrious of her sons.

To give even a résumé of Pasteur's life-work

would fill a large volume. The record of his achievements is the history of a great and important branch of science. He has opened up new avenues of knowledge, and has given an explanation of many facts and phenomena that had before been involved in obscurity and mystery. He has enlarged the domain of chemistry and biology, and has raised medicine from an empirical art to a veritable science. Columbus-like, he has discovered a new world—"The world of the infinitely little," as Pouchet was wont to call it—and demonstrated that it is this world which is the chief agent of all the changes which we witness in organized matter, and that it is the prime, if not the sole, cause of all forms of disease.

Now that the eyes of the world are turned toward Pasteur as the one whose researches have promised a cure for that dread visitant of Asia, the cholera, I am sure my readers will be pleased to learn something of the one who has been officially designated "the glory of France, the benefactor of agriculture and of French industries"; of one, too, who is no less distinguished as a devoted Catholic than as an eminent scientist; of one who, while an ornament to science as well as an honor to religion, glories more in being known as a son of the Church of Rome than in being recognized as one of the immortals of the Institute of France.¹

¹ Although this article appeared nearly three years before Pasteur's death—he died Sept. 28, 1895—I have deemed it best to leave it as it was originally written.

Louis Pasteur was born December 27, 1822, and hence will soon have reached the allotted term of "three-score and ten years." He was an only child, and from his earliest years he exhibited the germs of those talents that in after-life were to render him so famous. His good and devoted parents, although of humble means, determined to give him a good education, and to attain this end they spared no efforts, and considered no sacrifices too great. "We will," they proudly declared, "make him an educated man"; and how well the youth seconded their wishes is attested by his subsequent career.

At an early age he manifested a marked taste for chemistry and physics, the pursuit of which soon became his controlling passion. He loved to converse with those who could add to his information on these subjects, and never felt happier than when in the company of those who had already won distinction in some of the departments of chemical or physical science. Scientific experiments always had a special charm for him, and he eagerly embraced every opportunity by which he could extend his knowledge of Nature by laboratory work. While yet a young man he evinced a talent for the art of experimentation that commanded the admiration of all who saw him, and which eventually made him an adept without a peer.

Joined to his taste and talent for experimental work, and to his dexterity and skill in the manipulation and designing of instruments, he seemed to

be imbued in an eminent degree with the spirit of the inductive philosophy. No one, indeed, has ever employed the inductive method of research more generally or more successfully than he. And the facility with which he could make inductions, even in the most puzzling cases, was marvelous even to those who knew best the genius of the man. But with all this he never lost sight of the natural limitations of the method that served his purposes so well. Unlike many scientists of our day, he never permits himself to use the method of induction where deduction alone should be paramount. When dealing with questions of philosophy or religion he employs the principles of Catholic theology and metaphysics, and not those of a system that is available only for sciences which are based on observation and experiment. Like his distinguished countrymen, Mersenne and Ampère, he seems to possess an intuitive knowledge of the best methods of questioning Nature and of drawing from her those secrets which she discloses only to the favored few. Like Faraday and Koenig, he is endowed with a mind fertile in resources, and a genius that is quick to devise apparatus and methods for proving or disproving a theory. No one can interpret more readily than he the language of experiment, or recognize more surely the principles which underlie the phenomena observed, or discover more readily the laws to which experiment leads.

Pasteur's first honors were won in the domain of

molecular physics. In this branch of science, which he pursued in the celebrated *École Normale*, at Paris, he was fortunate enough to offer a solution of some questions that had long baffled the ablest chemists and physicists of Europe. But scarcely was he fairly started in this line of work, for which he had a special inclination, when an incident occurred which changed completely the nature of his investigations. This was his appointment, at the early age of thirty-two years, as Dean of the Faculty of Science at Lille. Here he soon found himself engaged in the study of the then obscure subject of fermentation. Some experiments which he made while at the *École Normale* led him to suspect that fermentation was in some, if not in all, cases due to the action of certain microscopic organisms. He was not long in proving the truth of his assumption, and in opening up that new world of "the infinitely little" whose discovery has made Pasteur so famous, and rendered him such a benefactor of his race. One experiment suggested another, and a number of the most brilliant and far-reaching discoveries followed in rapid succession. According to the old theory, which the great German chemist, Justus von Liebig, revived, fermentation was only a form of oxidation, and could take place only in contact with air. The illustrious chemists, Berzelius and Mitscherlich, gave a different explanation of the phenomenon. According to their view, a ferment was endowed with a very mysterious force, to which they

gave the name *catalytic*, and it brought about decomposition of fermentable matter by its mere presence, or by simple contact with matter capable of being fermented.

Pasteur was not slow in demolishing Liebig's theory, by demonstrating that fermentable matter never ferments when in contact with perfectly pure air or oxygen. More than this, he proved, in the most conclusive manner, that in many cases air and oxygen not only impede, but are absolutely fatal to fermentation. He demonstrated the falsity of the theory of Berzelius and Mitscherlich by showing that fermentation, far from being the result of some mysterious catalytic force, was in reality only a phenomenon of nutrition. He showed that what had previously been regarded as a ferment was only matter capable of being fermented; that the real ferment was, in every case, a minute microscopic organism which had hitherto eluded detection.

Observations made by Leeuwenhoek, Cagniard-Latour, and Schwann on the nature and action of yeast seemed to point to a possible connection between the phenomena of fermentation and living organisms, but these observations, important as they were, remained barren of results until the subject was taken up anew by Pasteur. Touched by his magic wand, one ferment shed light on the nature and habits of another. Indeed, the first successful experiment made by the eminent biologist regarding the cause of fermentation was to him an open se-

same which disclosed a new order of life whose existence until then had not even been suspected.

He not only discovered that fermentation was due in all cases to microscopic organisms, but that different fermentable bodies are acted upon by different ferments. Thus, the ferment of milk is different from that of butter, while that of beer is different from that of wine. Milk curdles, butter becomes rancid, beer deteriorates, wine sours, not because of oxidation by the air, as Liebig and others imagined, and still less because of some mysterious catalytic force, as others conjectured, but because they are acted upon by the countless microscopic organisms which find in these various substances their proper aliment. What serves as good for one ferment will not afford nourishment to another. In this respect, these lowest forms of life are as different from one another, probably more so, than are forms of life which are much higher in the scale of animated nature.

From the phenomena of fermentation to those of putrefaction and slow combustion was but a step. The clear vision of Pasteur saw at a glance that the difference between these various phenomena was nominal rather than real. The putrefaction of flesh and blood, the rotting of wood and leaves, the decay of all forms of animal and vegetable matter were only modifications of the same process that obtains in fermentation. Owing to the presence of sulphur and phosphorous in animal matter, elements that are

not found in vegetable tissues, the fermentation of animal compounds is attended with the evolution of certain foul-smelling gases that are never found among the products of vegetable decomposition.

In all these cases the agents of change and destruction are microscopic animalculæ of various species and forms, sometimes little round cells, at others minute rods of varying length; in one case straight, and in another curved or spiral-shaped. They attack dead matter internally and externally, and multiply at a rate that the imagination fails to grasp.

These little cells and rods vary in diameter from the one twenty-fifth to the one fifty-thousandth of an inch in diameter. But if thus infinitesimal in size, they, under suitable conditions, soon become almost infinite in number. One of these microbes, it has been computed, will in a single day give rise to no less than twenty millions of similar organisms, each of which is capable of producing other microbes at a similar prodigious rate.

Early in the course of his investigations, Pasteur discovered that the micro-organisms which are the causes of fermentation, putrefaction, and slow combustion might be divided into two distinct classes. Some required a supply of air or oxygen in order to live. These he called *aërobia*. Others, he found, could exist without oxygen. To some, even air is fatal. These he named *anaërobia*. In some cases of fermentation only aërobic microbes occur, while in

others anaërobic organisms alone are present. In still other cases both *aërobia* and *anaërobia* are at work, the former on the surface of the decaying body, the latter in the interior, away from contact with the atmosphere. These investigations and discoveries threw a flood of light on a number of phenomena which many men of science had essayed to explain, but in vain. Their first announcement in the French Academy, of which Pasteur at an early age had been elected a member, came as a revelation, and opened up a vista, the extent of which even now, after so much has been accomplished, can not be fully realized. To Pasteur himself, each new discovery served as a powerful search-light that illumined the broad but unknown field before him, a field which he had determined to explore, with what success the whole world now knows.

Forms of life which were unknown before Pasteur began his researches were now found to exist everywhere and in countless numbers. The atmosphere is so filled with them that only by special precautions can air be obtained that is absolutely free from them. Every object that meets our gaze swarms with them. Smaller, even, than the invisible motes in the sunbeam, they can be seen only under the higher powers of the microscope, and then frequently only as simple, structureless cells. And yet they are endowed with a vitality and a capacity of changing and destroying the higher forms of organic matter that excites our astonishment more in pro-

portion as we study them more closely. They are veritable masters of the world. They preside over the work of death, and return to the atmosphere all that which has been endowed with life, whether animal or vegetable.

After having demonstrated the ubiquitous character of these micro-organisms, and shown what powerful agents they are in the decomposition of animal and vegetable matter, Pasteur found himself the possessor of the key to the solution of a number of problems of the highest practical importance. Among these were problems regarding the manufacture of vinegar, wine, and beer.

From time immemorial, manufacturers of these staple articles of commerce had experienced numberless difficulties not only in their manufacture, but still more in their preservation. All sorts of theories were advanced to explain the difficulties encountered. Some thought that the real cause of the trouble was to be sought in the oxygen of the air. Others imagined that the various constituents of these liquids have a tendency to react on each other, and that the character of the product is determined by the nature of this molecular agitation. Pasteur, however, demonstrated, by a series of experiments, which were as brilliant as they were decisive, that all these views were radically wrong. All the changes observed, he showed, were due to certain *living ferments* which filled the air, and swarmed on the surfaces of the casks in which the liquids were con-

tained, or existed in myriads in the liquids themselves. In this wise he explained the turbidity and impoverishment of vinegar, the acidity and bitterness of wine, and the sourness and putridity of beer.

Pasteur, however, was not content with directing attention to the causes of the change, but continued his researches until he was able to indicate how such deleterious alterations might be prevented. Naturally, the first thing to do was to destroy the active agents of fermentation, the little microscopic organisms that cause the deterioration of wine and beer. And this he did by a method which was as simple as it was scientific. He soon found that a temperature of about 140° F. was fatal to the life of the microbes that infested beer and wine. Nothing, then, was easier than to raise these fluids to this temperature and thus destroy all the organisms and germs of organisms which might exist therein. By this short and simple process both wine and beer are rendered proof against fermentation, and can be transported from place to place, and in any climate, without danger of deterioration. This process of preserving wine and beer is extensively employed in both Europe and America, and has already been the means of enabling the manufacturers of these articles to guard against the very heavy losses which they formerly sustained. As applied to beer, the process, in honor of its discoverer, is known as "Pasteurization," and the beer itself is called "Pasteurized" beer.

While engaged in his investigations of the nature of fermentation, Pasteur was suddenly confronted with a problem that had occupied the mind of philosophers since the time of Aristotle, viz., that of spontaneous generation. For centuries it had been taught that many, if not all, of the lower forms of life, especially animal parasites, come into the world spontaneously; that is, that they do not proceed from pre-existing germs, and have not parents like themselves. The distinguished Italian scientist and ecclesiastic, Abbate Spallanzani, the naturalist, Redi, and Malpighi, physician to Pope Innocent XII., were the first to show that the alleged cases of spontaneous generation have no foundation in fact. It was, however, reserved for Pasteur to give the death-blow to a theory which had obtained for nearly three thousand years, and to demonstrate, by the most rigorous and precise experiments, that in the lowest and simplest of microscopic organisms, as well as in the higher forms of life, every living thing springs from some pre-existing germ and has, and must have, a parent like itself.

At the termination of his researches, which were characterized throughout by logical acumen and consummate skill, Pasteur announced in the Sorbonne, with all the positiveness of one who is certain of what he declares, that "there is not one circumstance known at the present day which justifies the assertion that microscopic organisms come into the world without germs or parents like themselves.

Those who maintain the contrary have been the dupes of illusions and of ill-conducted experiments, tainted with errors which they know not how either to perceive or avoid. Spontaneous generation is a chimera."

The controversy about spontaneous generation consequent on Pasteur's experiments, excited the keenest interest throughout the scientific world. The atheistic school of science ranged themselves against Pasteur in a solid phalanx, because they foresaw in the disproof of spontaneous generation a scientific demonstration of the falsity of their theories regarding the nature and origin of life.

Atheists and materialists, like Hæckel, Vogt, and Büchner, had boldly denied the existence of a Creator, on the ground that such a belief was unscientific. Starting with the assumption that matter and force are eternal, they proclaimed that all the phenomena of the universe could be explained by the interaction of known physical forces, and by the action of these forces on matter. Under the influence of magnetism or electricity, or both, brute matter, they contended, would give rise to the lower forms of animal and vegetable life. These primitive organisms once formed would, in virtue of inherent forces, and under the influence of a proper environment, in time develop into higher forms of life. The conclusion they drew from such reasoning was that God is unnecessary, and that, therefore, he does not exist. To such scientists, Pasteur's demonstra-

tion, that spontaneous generation is a chimera, was an *argumentum ad hominem*, which, on their own principles, was simply unanswerable. So much is this the case that no scientist deserving the name ever speaks of spontaneous generation except as an exploded theory, a theory that was long-lived, it is true, but which is now dead and apparently beyond any possibility of resuscitation.

While engaged in his researches on fermentation and spontaneous generation, Pasteur was urged by his friend, J. B. Dumas, to examine into the nature and cause of the silk-worm epidemic that was then rife in the south of France, and which threatened soon to destroy one of the most important industries of southern Europe unless a means could speedily be found for staying the plague and preventing further ravages.

Until this time Pasteur had never handled a silk-worm. He could not, however, resist the appeal made to come to the relief of his suffering countrymen, and although the work he was called upon to do threatened to withdraw him indefinitely from the researches in which he had met with such signal success and which promised him still greater triumphs, he determined thoroughly to investigate the silk-worm disease and not to relinquish the self-imposed task until he should bring it to a successful issue. His researches on fermentation and spontaneous generation had prepared him for the work, and he was better qualified for such an undertaking than

any man living. From the outset he was led to believe that the real cause of the trouble would be found in certain micro-organisms similar to those which occasioned the maladies of vinegar, beer, and wine. Nor was he long in demonstrating the truth of his assumption. Pursuing the same methods that had led to such happy results on former occasions, he was soon able to show that the plague was due to certain corpuscles and microbes with which the silk-worms were infected.

Having discovered the cause of the evil, the next step was to provide a remedy. This also he was able to do, but only after countless experiments and the most arduous and protracted labor. So incessant, indeed, was the toil, and so numerous were the difficulties that beset his path, not to speak of the criticisms and opposition which his investigations provoked, that his system yielded to the pressure and for a time his life was despaired of. In 1868, three years after he had entered upon the study of the epidemic, he was stricken with paralysis of one side, from which he still suffers. Two years subsequently, however, he brought his researches to a close, and had the gratification of seeing his method of preventing the plague in successful operation in all the great centers of silk husbandry, and of feeling that he had rescued from what seemed to be certain destruction one of the favorite and most profitable industries of his native country. His discoveries saved thousands of people from penury

and starvation, and secured to the treasury of the nation an annual revenue of millions of dollars that would otherwise have been dissipated, perhaps forever. As a mark of appreciation of his work, Napoleon nominated Pasteur a senator, and learned societies of different nations hastened to show him that honor which his admirable achievements had won for him. But Pasteur's greatest reward was the general outburst of gratitude of the thousands of the laboring poor whom the pest was on the verge of depriving of employment, and, with it, home and the means of subsistence.

Having so completely triumphed over the silkworm epidemic, Pasteur next directed his attention to the study of infectious diseases in man and the higher animals. From the time he began the study of microbial life, each of his researches seemed to be the stepping-stone to that which followed, and to corroborate the theory that he was the first to promulgate regarding the nature of fermentation and virulent disease. He beheld everywhere those "infinitely little" forms of life, which to him were infinitely great. He knew, too, that these were in all cases the offspring of antecedent life, and hence he was able to conduct his experiments and guide his researches with a clearness of vision and with a certainty of induction that otherwise would have been quite impossible. He took nothing for granted. He proved or disproved every proposition as it was presented to him, and always cleared the way of all obstacles

before attempting an advance. His logical, perspicacious mind would not permit him to pursue a different course. Past experience had shown him that this was essential to success, and the rigid, inductive method by which he had achieved such marvelous results had become so engrained in his mind that working in strict accordance with it had become to him a second nature.

Previous to the investigations of Pasteur, a theory had obtained among certain naturalists and physicians that contagious diseases might be due to animalculæ and microscopic parasites, but no definite information had been obtained on the subject. And then, too, doctors and chemists were slow to accept a theory which was so diametrically opposed to that sanctioned by the name and fame of Liebig. According to the illustrious German chemist and his school, vital action had nothing to do with the genesis of disease. The contagia of disease were not, according to them, living things, as we now know them to be, but were rather the results of certain molecular changes, entirely chemical in their nature, which communicated themselves to different portions of the living subject. According to this view, diseases, especially those of a communicable character, were engendered by certain viruses, morbid influences, pandemic waves, atmospheric invasions, pythogenic media, and other equally mysterious agencies, all of which were entirely independent of any definite living organisms.

The first of the infectious diseases to engage the attention of Pasteur was the terrible malady known as splenic fever. From time immemorial this devastating plague has created greater havoc among domestic animals than any other cause. In France alone, in certain years, the losses amounted to from fifteen to twenty million francs. In other parts of both the Old and the New Worlds equally formidable losses are occasioned by the pest. Man, too, as well as his flocks and herds, was subject to the disease, and large was the tribute of human victims annually demanded by the fell disorder.

Not long after commencing his researches, Pasteur was able to show that the cause, and the sole cause, of the malady in question, was a peculiar form of microbe known as a bacillus or bacterium. Having discovered the cause of the disorder, he set about with characteristic determination to find a counteractive. The work was long and difficult, and not without danger. But great as were the difficulties encountered, they succumbed perforce to the genius and perseverance of the experimenter.

Pasteur was successful in finding not only the object of his quest, but had, at the same time, the good fortune to make a discovery which was as important and as far-reaching for pathology as was that of gravitation for astronomy. It was no less than an extension of Jenner's great discovery of vaccination.

After long and toilsome vigils, and a series of

experiments, whose number and ingenuity fill one with admiration and awe, Pasteur found that he could attenuate the virus of splenic fever to any degree of potency, and that such virus could be employed to inoculate against the disease itself. When he first announced his great discovery in the Academy of Sciences it was received with loud applause, but so extraordinary was it deemed that there were few who did not consider it too good to be true. Every one saw that the discovery, if real, meant a complete revolution in the theory and practice of medicine and surgery. If the virus of splenic fever could be attenuated and the disease could be prevented by inoculation, was it not reasonable to suppose that the same processes would yield similar results in the case of all infectious diseases? As for Pasteur himself, so thoroughly had he studied the nature and habits of microscopic parasites, and so thoroughly had he mastered the ætiology of contagious diseases, that he was convinced that his discoveries in connection with splenic fever would eventually admit of universal application. Subsequent experiments and investigations by himself and others have fully realized his most sanguine expectations, and furnished to the world another and striking instance of the remarkable clearness and compass of his view as an interpreter of Nature and Nature's laws.

Since Pasteur commenced his researches on fermentation and putrefaction, the trend and goal of

medical and surgical science have been in the direction indicated by the germ theory of disease, as contra-distinguished from the misleading and unfruitful theory of Liebig and his followers. As a consequence, the results obtained have been as marvelous as the germ theory is comprehensive.

No sooner was Pasteur's great discovery made public than he was called upon to give a demonstration, on a large scale, of the efficacy of his method of treatment. And so successful were his experiments that all doubts as to the truth of his predictions were at once dispelled. Even those who had been most skeptical united in admitting the conclusiveness of the demonstration which had been given, and in proclaiming that Pasteur's discovery marked the beginning of a new era in the annals of veterinary science, as well as a grand step forward in economic stock-raising. The vaccination of sheep, horses, and cattle soon became general, and was everywhere resorted to as a sure preventive against the malady that for centuries had so decimated the flocks and herds of Europe and the Orient, not to speak of the ravages it had caused in the New World, especially in parts of South America.

But Pasteur's researches, important as they were in conserving and promoting some of the most important of the world's industries, were of still more value when applied to the treatment of human diseases, which annually claim so many thousands of victims. Not to speak of splenic fever, to which

allusion has already been made, of septicemia, and other equally grave maladies, it will suffice here to instance the antiseptic method of surgery introduced by the celebrated Lister, which is almost universally employed, and which has been productive of such beneficial results.

Previous to the introduction of the system of this famous surgeon, the mortality in the hospitals, consequent on wounds and surgical operations, was frightful. Acting in accordance with principles based on Pasteur's discoveries, Lister was able to reduce the percentage of deaths to a small fraction of what it had previously been. In a letter addressed to Pasteur the eminent English surgeon writes: "Allow me to take this opportunity of sending you my most cordial thanks for having, by your brilliant researches, demonstrated to me the truth of the germ theory of putrefaction, thus giving me the only principle which could lead to a happy end the antiseptic system."

In Listerism, as in Pasteurism, the practitioner or operator is not left in the dark as to the agencies he is combating. He is not fighting against some problematic virus, or some mysterious influence, but against a visible, tangible entity. The problem before him is to remove or destroy certain parasitic organisms, whose habits and life-history have been carefully studied and are thoroughly understood. Knowledge takes the place of theory, and certainty

supersedes speculation and processes which were at best only tentative.

Pasteur's researches on splenic fever, septicemia, fowl and swine cholera, and his discovery of vaccines, together with a method of attenuating the most virulent viruses for combating these maladies, paved the way for still greater undertakings and for more brilliant conquests.

Encouraged by the results he had already realized, and confident of the general applicability of his discoveries, he next proceeded to investigate that formidable malady which had hitherto baffled all attempts to arrest it by therapeutical agents. For generations rabies, or hydrophobia, had claimed annually a large number of victims, especially in France and Russia. When fully developed it was regarded as being as incurable as the leprosy, while the intense sufferings which characterized the disorder were such as to make it the most dreaded of bodily afflictions.

For several long years Pasteur, with a corps of devoted and enthusiastic assistants, labored at the problem with all the zeal and energy so characteristic of his nature. Thousands of experiments were made and recorded, tens of thousands of observations were compared and classified, and all with the most scrupulous care and exactitude. Finally, he was rewarded by finding himself able successfully to inoculate dogs against the most virulent forms

of the disease. Just at this stage of his investigations he was visited, July 6, 1886, by two persons from Alsace who had been bitten by mad dogs. One of these was Joseph Meister, a lad nine years of age, who had received no fewer than fourteen wounds, and whose death seemed inevitable. After consulting with some of his associates, and not without great anxiety as to the outcome, Pasteur determined to try on the hapless young victim the method of inoculation that had yielded such promising results in the laboratory. He awaited the effect of his treatment with the greatest solicitude, until, after the lapse of some weeks, he was assured that the patient was out of danger, and that he himself had achieved a glorious victory over the most terrible malady with which humanity can be afflicted.¹

In a short time a magnificent structure, the Institut Pasteur, was erected to serve the double purpose of laboratory and hospital, and here for a time might be seen patients from all parts of Europe. But so pronounced was the success of the new treat-

¹It may interest my readers to know that young Meister, a bright youth of sixteen, is now connected with the Institut Pasteur. He accompanied me through the laboratories, and the out-buildings in which are kept the scores of dogs, rabbits, guinea pigs, pigeons, etc., which, after inoculation supply the virus used in the operating-room, or which are required for the experiments that are being conducted by physicians and biologists from all parts of Europe and America. The highest ambition of young Joseph is to become a doctor, and to spend his life in the Institut Pasteur. It is needless to say that he has an unbounded admiration for the one who snatched him from the jaws of the most frightful of deaths. "I think," said the boy to me, "that Pasteur is the greatest man that has ever lived."

ment that similar institutions were called for and established elsewhere. Now there are upward of twenty of them in different parts of the Old and New Worlds.

From the very great mortality which formerly characterized the malady, the percentage of deaths has been reduced to a small fraction of one per cent. Hence, it will be seen that the method is well-nigh perfect, and success in any given case, if taken in time, is almost certain.

For some years past "the great savant of France," as his countrymen love to call him, has been devoting special attention to that dread scourge of Asia, the cholera. Will he be as successful this time as he has been in his previous undertakings? As to myself, I have no doubt about the result. Armed with the accumulated knowledge and experience of nearly half a century, endowed with a genius for experimentation such as no other man probably ever possessed in such an eminent degree, and provided with all the appliances that ingenuity can devise, or that the most liberal institution can supply, we need entertain no doubts as to the outcome of the experiments which are now being conducted at the Institut Pasteur. Even at this writing there is reason to believe that Pasteur has arrived at a solution of the problem on which he has been so long laboring. But he is so cautious and conservative that he never makes an announcement until he has studied every phase of the case, and made allowance for all con-

tingencies. When he does finally announce a cure for cholera, we may have the same confidence in its efficacy as every one now has in his treatment of the other virulent diseases over which he has so signally triumphed.¹

In the researches with which he is now occupied Pasteur is not groping in the dark, or dealing with some occult power that eludes his observation. On the contrary, the enemy he has to combat is as real and tangible as a corps of Prussian soldiers. He is fully acquainted with its nature and strength, and with its methods of advance and attack. The problem now before him is not the location of the foe, for he has it always under his eye, but to devise some means of staying the progress of the invader, or, if possible, of destroying it by turning it against itself, by the same system of inoculation that has worked so admirably in the case of splenic fever and hydrophobia.

Until, by observation and experiment, he has made himself sure of the ground on which he stands, Pasteur is the most diffident of men. But once he has experiment to back him up, he fights with a boldness and an impetuosity that to an onlooker savors of rashness. But he is not rash. He is the most prudent and conservative of scientists. He is

¹When I last saw Pasteur, not long before his death, he told me that he had just received word from one of his assistants in India, where experiments were being conducted in the cholera-stricken districts, which removed all doubt regarding the success of his method of inoculating against cholera.

bold because he is certain that he is right. Woe betide the unfortunate adversary who falls into his terrible hands! for, as a member of the Academy of Science once said to a member of the Academy of Medicine, who spoke of scientifically strangling the illustrious biologist, "Pasteur is never mistaken."

To few men has it been vouchsafed, as to Pasteur, to witness the beneficent results of their labors and discoveries. No man has encountered more opposition than he; no man has fought more and fiercer battles; no man has won so many victories. He has now the satisfaction of seeing his theories almost universally accepted; of knowing that his principles are everywhere triumphant, and that his discoveries have been instrumental in effecting untold good for the amelioration of the condition of suffering humanity.

Honors have been showered upon him by his own and by foreign countries, and throughout the civilized world he is reverently spoken of as one of the greatest benefactors of his race.

In 1862 he was elected a member of the French Institute, of which he has ever since been one of the most indefatigable and successful workers, as well as the most distinguished representative. The French government has granted him a pension of 20,000 francs "in consideration of his services to science and industry," a form of recognition that has but few, if any, precedents in France, but something that was more than merited. In 1868 he was awarded a

prize of 10,000 florins by the Agricultural Minister of Austria for his researches on the disease of silkworms. Five years later the Société d'Encouragement awarded him a prize of 12,000 francs for his studies on fermentation, and for the remedy discovered by him for the silk-worm disease.

A recent writer, in referring to Pasteur, speaks of him as one "whose researches have yielded so much material profit that one thinks of him as of the orange-tree standing in all the glory of blossom and fruit at the same time." With truth, therefore, did Professor Huxley declare that "Pasteur's discoveries suffice, of themselves, to cover the war indemnity of five milliards of francs paid by France to Germany."

This is a great deal to say of the work of one man, but to any one acquainted with the marvelous achievements of the distinguished Frenchman it will not appear as an exaggeration. But, extraordinary as is the work that has already been accomplished, much yet remains for future observers and experimenters. Pasteur himself acknowledges that his discoveries are but the beginning of the grand triumphs which the future shall witness. "You will see," he frequently remarks, "how it will all grow by and by. Would that my time were longer!"

For the past third of a century Pasteur has been a prolific writer. Besides his communications to the French Academy, and numerous contributions to scientific journals, he has written several works

on fermentation, and on the maladies of wine, beer, vinegar, and the silk-worm, which, since their publication, have been the acknowledged standards on the subjects of which they treat. He has a clear, trenchant style, and in all his productions he shows himself a consummate master of the art of exposition. Some of the addresses he has delivered before the Academy are models of chaste and polished diction, and exhibit a *verve* that betokens a highly-cultivated imagination, as well as true poetic instinct. They are especially remarkable for the manner in which he champions the cause of revealed truth, of which he has on all occasions shown himself an ardent and intrepid defender.

In his discourse pronounced on the occasion of his reception into the French Institute, he referred to the teachings of faith as an instrument of progress and as a safeguard for the man of science, and declared that if we were deprived of the conceptions due to these teachings, "science would lose that grandeur which it possesses in virtue of its secret relations with the divine verities." On another occasion, two decades later, when delivering the eulogy on M. Littré, one of his *confrères* in the Academy, the old man eloquently tells his associates of the Institute that "the conception of the infinite in creation is everywhere irresistibly manifest. It places the supernatural in every human heart. The idea of God is a form of the idea of the infinite."

Not only has Pasteur on all occasions the cour-

age of his convictions, but he puts in practice the faith he so openly and courageously professes. I have said that he is prouder of being a Catholic than of being an Academician. This is characteristic of the man. Worldly honors are to him but ineffective baubles and hollow gewgaws, except in so far as they are an evidence of what he has achieved for the betterment of the condition of his fellow-men.

Of a charitable and generous nature, he is ever ready to extend a helping hand to the poor and the afflicted. Shortly before my last trip to the Institut Pasteur a good religious brother brought to him a boy who had just been bitten by a rabid dog. The brother explained to M. Pasteur that the parents of the lad were in very straitened circumstances, and would not be able to pay much for the treatment of their son, or for his maintenance at the hospital. "Leave that to me, please, *mon frère*. I shall provide for the boy myself and see that he receives every attention. Call for him ten days hence, and he will be well and out of danger." Ten days later the lad was returned to his overjoyed parents, and without a centime of expense to them, sound and whole. It was difficult to tell to whom this kind action brought the greater happiness; the parents, whose son had been rescued from an imminent and frightful death, or Pasteur, who had given the patient a new lease of life, when, but for his skill, there was little or no hope for its conservation. But this is only one of the many instances of his liber-

ality and kindly disposition. He is always, in a quiet and unobserved way, performing just such noble actions, and there is not, I venture to assert, a single person in the whole of Paris to whom the poor and unfortunate can appeal with greater assurance of comfort and relief.

Notwithstanding his long experience in the laboratory and his familiarity with every phase of brute and human suffering, Pasteur still retains a nature as gentle and a heart as tender as a woman's. While talking with him one day in the Institut Pasteur, in a hallway adjoining the operating room, we presently heard the smothered cry of a child who was being inoculated against rabies. Pasteur started with an expression of deep anguish. "Come away," he said, "where we cannot hear these cries of pain. I am neither a physician nor a surgeon, and I cannot bear such sounds of distress."

Contrary to what is generally supposed, Pasteur does not operate on any of the thousands of patients who annually flock to his laboratory. He delegates the work of inoculation to a staff of trained surgeons, who prepare and administer the prophylactic virus under his immediate supervision. I have never seen him in the operating room, and he studiously avoids it unless called there by stern duty, which he never shirks. He cannot endure any exhibition of human suffering, and he is as little inured to it to-day as he was when he began his researches on the ætiology of virulent disease.

It is difficult to appreciate the magnitude and importance of Pasteur's life-work, or to over-estimate the extent to which mankind is his debtor. Like Copernicus and Galileo, Kepler and Newton, he has cleared away difficulties that before him were insuperable barriers to progress, and has demonstrated the existence of law and order where previously all was thought to be chance and chaos.

Alexander is called great because he worsted in battle the barbarous hordes of the East. Cæsar is awarded the laurel crown of victory for his conquests in Germany and Gaul. Napoleon is honored with triumphal arches, and saluted as the world's greatest chieftain, because he was able to vanquish the combined armies of Europe. In Pasteur we have one, who, in the seclusion of his laboratory, without noise and without bloodshed, has proved himself a greater conqueror than either Alexander, or Cæsar, or Napoleon. In him we honor the hero who has triumphed over the plague that for centuries had demanded such formidable tributes from all the nations of the earth. To him suffering humanity is indebted for illumining with the search-light of his genius a world, the world of the infinitely little, the world of microscopic parasites, that, prior to his time, had been shrouded in more than Cimmerian darkness. Chemists and biologists, physicians and surgeons, have to thank him for transporting them across a gulf seemingly more impassable than a Serbonian bog, and putting them in a position to

cope with an enemy which had hitherto occupied a coign of vantage from which it could not be dislodged. Hence, so long as disease shall continue to claim its victims, and so long as suffering may be assuaged; so long as men shall esteem worth and merit, and so long as gratitude shall find a place in their hearts, so long also will the world applaud the achievements and be moved by the example of that illustrious votary of science, and that loyal son of the Church, Louis Pasteur.

CHAPTER IX.

A NEW SYSTEM OF WRITING FOR THE BLIND.

FROM the earliest ages of Christianity those afflicted with the loss of sight have ever been objects of pity and commiseration, but, strange as it may appear, little was done for their instruction and for the amelioration of their condition of dark and perpetual isolation until the end of the last century. Then it was that M. Valentin Haüy, the brother of the illustrious Abbé Haüy, the father of crystallography, entered upon his philanthropic career, and proved to the world not only the possibility, but also the practicability, of the general education of the blind.

In 1784 he inaugurated in Paris the first institution for the education of the blind which had ever been successfully attempted. Previous efforts, it is true, had been made by divers persons to enable the sightless to enjoy some of the advantages of an education, but these were attended with only very limited success. As early as 1670 Padre Lana Terzi, an Italian Jesuit, wrote a treatise on the instruction of the blind, while almost a century later the Abbé Deschamps drew up a plan for their in-

struction in reading and writing. But these were only tentative efforts which were not destined to issue in any practical or lasting results.

Haüy was the first one who had the happy idea to print in characters which could be recognized by the touch. His first book, "Essay on the Education of the Blind," printed in raised or relief letters, was published in 1786, and was subsequently translated into English by the blind poet, Dr. Thomas Blacklock. By Haüy's invention the blind were enabled to read with their fingers, but as yet no means had been devised which would enable them to write.

The first one to propose a practical and successful method of writing for the blind was M. Louis Braille, a blind pupil of the Institut des Jeunes Aveugles in Paris. This was in 1834. The merits of Braille's invention were at once recognized, and his system of writing, like Haüy's system of reading, was soon almost universally accepted and employed in the education of the blind. Other systems both for printing and writing soon followed those of Haüy and Braille. Among these are to be noted that of the Abbé Carton, a modification of Braille's, which has had a certain vogue in Belgium. In some of the systems introduced Roman letters, more or less modified, are used. In others, stenographic characters are employed, while in others still, a phonetic alphabet is adopted. The systems which have been in most general use in Great Britain and the United States are those devised by Fry, Moon,

Alston, and Howe, in all of which the characters deviate more or less widely from Roman letters. In France, with the exception of one institution, Braille's system prevails universally both for printing and writing. It is also extensively used in Belgium, Switzerland, and Holland, while for writing it is employed in almost all the countries of Europe.

Although open to some objections, Braille's system is quite simple both for the purposes of printing and writing. As is well known, all the characters, according to this method, are composed of varying combinations of six dots. But useful as is this system of tangible point writing and printing, and great as are the blessings which it has conferred on the blind, it still leaves much to be desired. It is indeed an advance on the invention of Haüy. This philanthropist made reading possible for the blind; Braille taught them how to write with facility. But designed as it was for the blind, his invention was of little or no service to them when they wished to correspond with those who are blessed with eyesight. Consisting of purely arbitrary signs, entirely different from those composing the ordinary alphabets used by persons endowed with the power of vision, it afforded them no assistance when they desired to communicate with those who were ignorant of the system.

For this reason, notwithstanding all that had been achieved for the behoof and advancement of the blind, it was necessary to make yet another step

forward before these hapless people could communicate readily with their more fortunate brethren. It was, in a word, necessary to devise a system which both the blind and not-blind could readily understand and use. And this invention, important and far-reaching as it is, has actually been effected, although little or nothing has yet been said or heard of it, at least outside of France, where for some years past it has been undergoing a thorough test in a certain private institution which is destined sooner or later to become famous.

The inventor of the new system is a lady, Mlle. Mulot, of Angers, France. The institution wherein the method has been put to the test is a school under the direction of the inventress herself, and is known as L'École des Jeunes Aveugles. Wonderful results have already been achieved by the use of the system, and it may be safely predicted that it is only a question of time until it will supersede all others in both Europe and America. Discarding all the arbitrary signs and symbols which had been hitherto employed, Mlle. Mulot makes use of the ordinary Roman letters, and at once cuts the Gordian knot, which had so long puzzled some of the keenest minds of the educational world. By means of a simple frame, contrived for the purpose, and a blunt style, she has made it possible for the blind to correspond not only with the blind, but also with the seeing with equal readiness and satisfaction. The most astonishing thing about the invention is its

simplicity, and like many other extraordinary discoveries, it now seems strange that the idea did not occur to some one long before.

The frame, or stylographic guide, employed is essentially nothing more than a metal plate—ordinarily, there are two of them hinged together for the sake of convenience—in which there is a number of square perforations arranged in parallel lines. At each corner of these perforations there are small indentations which enable the writer not only to move his style in and around the aperture, but also permit him to move it up and down, thus forming vertical lines at the right and left of the little squares. By moving the style from one angle to the other of the perforation, or from little notches, cut on the four sides of the square, it is possible to write with the greatest ease and exactness the ordinary letters, large and small, of the Roman alphabet. Thus the letter u is composed of one horizontal and two vertical lines, the letter x of two diagonals, while the letter o, is made up of two horizontal and two vertical lines, all slightly curved. For letters like b, d, p, q, the writer is obliged to move his style into the proper indentation at one of the corners of the square. Thus, d would be made like the letter o with a prolongation upwards of the vertical line at the right.

When it is desired to use the instrument in writing to the blind, a sheet of letter-paper is placed under it, and above a sheet of blotting-paper, which serves

as a cushion. The blind person writes from right to left of the sheet, while the style, by reason of the blotting-paper underneath, brings out the letters in relief on the side opposite that on which they are written. On looking at the reverse side of the written page, the letters are seen in their natural position, and are read as in ordinary writing from left to right.

The letters, it is true, are not much raised, but the relief is quite sufficient to enable the delicate, well-trained fingers of the blind to distinguish them with the greatest ease and rapidity. When the matter written is intended for those whose vision has not been lost, a sheet of carbon-paper is placed between the cushion, or blotting-paper, and the paper on which the characters are written. The letters are then not only brought out in relief, as before, but they are likewise colored, as they are on the printed page from a type-writing machine.

So simple and so accurate is the method that even little children are, by its means, enabled to become expert writers in a comparatively short time. When ordinary care is taken, the letters made are of unvarying uniformity, and may even be of mechanical exactness. All the lines of the written page must be parallel, because the perforations in the frame are parallel; and the letters must be uniform, because all the little squares in the plate are of the same unvarying size. For this reason, a page written with the aid of Mlle. Mulot's device is not only per-

fectly legible to any one capable of reading ordinary writing, but it also exhibits far more regularity than is possible when the style or pen is held in the unguided hand.

But, remarkable as is the facility with which the blind can write with this machine, the rapidity with which they can form letters is even more astonishing. By frequent trials it has been demonstrated that they can take down ordinary dictations without difficulty, and with fully as great accuracy as those who have the use of their eyes. Already in a number of instances the pupils of Mlle. Mulot's school have presented themselves before the government examining-boards, and, without having had any favor shown them, have acquitted themselves quite as creditably as their more fortunate companions.

These successes, as yet but little known outside the circle of a few friends of Mlle. Mulot and her enterprising school, open up a grand vista to the educator and the humanitarian. Something that was impossible a few years ago, the education of the blind alongside those who are not blind, is now quite feasible, and it will not be long, I trust, before they will enjoy all the advantages which the new system is capable of affording them. Anything that can be taught by dictation can, by the new method, be learned almost as well and as quickly by the blind as by the sighted. It is, indeed, difficult fully to

realize as yet all the benefits that would follow from the general adoption of the new method, and to forecast the great amelioration that would result thereby in the condition of the blind. One of the most pitiful consequences of their misfortune, isolation, would at once be removed, and a new world of enjoyment and usefulness would, in consequence, be opened to them. Not only would the intensity of their affliction immeasurably be diminished by thus being able to associate with their more favored brethren, but the world would also don a brighter aspect to the friends and relatives of such unfortunates.

But it may be asked: "Why is it that a system which presents such marked advantages over all other systems has not been adopted ere this, at least in France, where those interested in such matters should surely be cognizant of its merits?" It is the old story of petty jealousy and the unwillingness on the part of the self-complacent officials of state institutions to admit that anything good can come from private enterprise or individual initiative. The professors and managers of the National Institute for the Blind in Paris are not unaware of the superiority of Mlle. Mulot's system, but their pride forbids them to acknowledge that the method followed in the humble little Catholic school of Angers is superior to that adopted in the institutions of the nation, or that the happy idea of a woman has enabled her

to accomplish what men had striven for but in vain, and what they themselves, were they but honest, would have been glad to achieve had they but been blessed with such good fortune as has been vouchsafed to her whose invention they affect to ignore and despise. Such ignoble jealousy and such tenacious conservation of antiquated methods in the face of others which are demonstrably simpler and better, are at all times reprehensible, but doubly and trebly so when they affect the well-being and progress of countless thousands of our sightless fellow-creatures. But truth and justice always triumph, and real merit is sure to be recognized sooner or later. One need not, then, be a seer to predict that it is only a question of time, and, I trust, but a very short time, until the beneficent system of Mlle. Mulot shall be known and adopted not only in France, but in all the institutes for the blind throughout the civilized world.

What precedes may seem to some an exaggeration of the merits of the new system, and yet I am far from having exhausted all that might be said in its favor. A comparison of a specimen of writing according to Braille's system with one according to the system devised by Mlle. Mulot, together with an illustration of the results which one is capable of attaining by following the new method, will prove incontestably that all that has so far been said in its behalf is based on facts which speak more eloquently than words.

In the following specimens of writing the first is according to Braille's method, and the second according to that introduced by Mlle. Mulet. In the first, the letters are composed of a certain number of dots variously arranged, and designed solely for the blind. In the second specimen, the characters employed are ordinary Roman letters, and are readily

Sochez donc
de L'ami
discerner
Le Flatteur

BRAILLE'S SYSTEM OF WRITING FOR THE BLIND.

M. MULOT'S SYSTEM OF WRITING FOR THE BLIND.

recognized by all who have the use of their eyes, and are as easily, if not more easily, distinguished by the blind as are the dots or raised points of the former. The first specimen is intelligible only to the sightless who are familiar with Braille's method; the second is read alike by the blind and the not-blind, and thus it affords a means of communication between the two classes of persons that is not furnished by the older system.

The proposition in both examples given is the same, and in both instances is expressed in French. Translated into English it reads: "Learn, then, to distinguish a friend from a flatterer."

I have already stated that some of the pupils of L'École des Jeunes Aveugles, at Angers, have had

their ability, as well as the system they followed, fully tested by the examiners of the government schools, and that they have stood the test in a most surprising manner.

But a far more remarkable illustration of the superior merits of the new system is supplied by the signal success of one of the pupils of Mlle. Mulot, M. Vento, a young man who has been blind from his birth.

M. Vento was a studious pupil and bright, although one would not say that he was exceptionally talented. Having pursued his studies in the school of Mlle. Mulot as far as she was able to take him, it was his good fortune to fall into the hands of Rev. Father Goupille, C.S.C., the present learned and sympathetic rector of the College of the Holy Cross, at Neuilly, near Paris. The good father's interest was at once aroused, and he immediately resolved to attempt what at first sight appeared almost visionary. He had examined Mlle. Mulot's system and recognized its capabilities; he had confidence in the intelligence and industry of M. Vento, and he accordingly determined to take him through a full classical course and prepare him for passing an examination and for taking his baccalaureate in the Sorbonne.

No one had ever entered upon such an undertaking before, or, if any one did, there is no record left of final success. Both teacher and pupil went to work with a will. Father Goupille took his pupil—

mon aveugle, as he always affectionately called him—through a thorough course of Greek, Latin, and French literature. The blind man was introduced to the beauties of Homer and Virgil, and made familiar with the choicest specimens of poesy and eloquence; ancient and modern history, logic and philosophy he likewise mastered, and in a way that surprised all who knew him. Science and mathematics he had studied before he met Father Goupille.

In due course of time M. Vento was ready to present himself for his degree. "Will your pupil be able to pass his examination?" I asked Father Goupille a few days before M. Vento faced his examiners in the halls of the Sorbonne. "*Sans doute*"—without doubt—he instantly replied. "Not only will he pass, but he will acquit himself with marked distinction." I thought at the time that he was a little over-sanguine, but subsequent events proved that I was mistaken.

Early one morning Father Goupille, his pupil, and Mlle. Mulot started for the Sorbonne. As I saw them setting out for this venerable seat of learning, I was, I must confess, quite curious to know what would be the result of their undertaking. On their part, however, there was neither doubt nor trepidation; for, on the faces of all three one could read the imprint of hope and confidence, the confidence that comes from a consciousness of knowledge and power.

The examiners of the Sorbonne were astonished beyond measure to see a blind man before them an applicant for a degree, but they could not discriminate against him on account of his misfortune; neither could they show him any special favor.

INSTITUTION N. D. DE SLE-CROIX



Mon R Père

90 Avenue du Roule
A Neuilly-S/S-SEINE

Mon succès distingué, comme
vous le vouliez, me semble
tout à fait vôtre; c'est bien
lui vous l'accorde, parce qu'
il vous aime.

A vous donc comme à lui

ma vive reconnaissance

Vento.

This last M. Vento neither expected nor desired. The same questions, accordingly, were given to him as were put to other candidates for a similar degree. The learned professors were amazed at the readiness and accuracy of the blind man's answers, and the facility and exactness with which he wrote his versions from Latin and Greek.

The result was, as Father Goupille had predicted it would be, a glorious success. It was a splendid triumph for pupil and teacher. Above all, it was the most striking and conclusive proof of the superiority

of the system devised by Mlle. Mulot for the education of the blind.

A short note from M. Vento to Father Goupille, written immediately after the result of the examination was made known, announces the issue of their joint efforts in words as simple as they are touching. I give (on preceding page) the note in French, with the subjoined translation:

“REV. FATHER: My distinguished success, as you desired it, seems to me to be entirely yours; it is God who accords it to you, because He loves you. To you, then, as to Him, my lively gratitude.

“VENTO.”

I append two more letters as specimens of what can be done by students who follow the system I have been describing. The first is a New Year's greeting from M. Vento to a distinguished friend of L'École des Jeunes Aveugles at Angers, and the other is a similar letter from one of the children of Mlle. Mulot's interesting institute. Not even the most exacting could demand stronger evidence of the superiority of the new system. Neither letter was written for public inspection, much less for the press, and yet they will bear the most searching criticism that the opponents of Mlle. Mulot are capable of making.

From the foregoing it will be seen that a new era has dawned for those who have so long lived in darkness and isolation. Mlle. Mulot's invention is destined, so soon as it is properly known and ap-

preciated, to revolutionize completely the methods at present followed in the instruction of the blind. She has accomplished a work that will secure for her the gratitude of countless thousands, and will place her among such noble benefactors of humanity as Haüy, Braille, and the Abbés de L'Épée and Si-

ÉCOLE
—
Jeunes Aveugles
—
ANGERS

22 dec 74

ÉCOLE
—
Jeunes Aveugles
—
ANGERS

decembre 74

Mon très Révérend Père

toujours vivement préoccupé de l'intérêt inestimable que vous avez bien voulu accorder à l'œuvre de M. Duval et à moi personnellement, je profite du commencement de la nouvelle année pour vous offrir, avec mes plus respectueux sentiments d'affection et de reconnaissance, les vœux les plus ardents de mon cœur. — Vanto.

Les petits aveugles d'Angers demandent tous les jours dans leur prière

du matin et du soir, que le bon Dieu bénisse la Congrégation de Ste Croix et envoie à chacun de ses Membres en particulier leurs meilleurs vœux de bonne et heureuse année.
Joseph Pécot

card, all, like herself, devoted children of Holy Church, who have contributed so much towards the amelioration of the condition of the blind, the deaf, and the dumb, and who have made it possible for these unfortunates to enjoy many of the pleasures and blessings of life which were before entirely closed to them.

When one remembers what a large percentage of our race is afflicted with blindness—one in one thou-

sand in temperate climates and a still larger proportion in other latitudes—one will realize more fully the greatness of the benefits which must accrue from the general introduction of Mlle. Mulot's method of writing. It puts within the reach of all who are deprived of sight a means of communication with their fellow-men, and of acquiring an education in the higher branches of knowledge that a short time ago would have been deemed impossible.

In times past, indeed, great things were achieved by the sightless. Huber, the celebrated naturalist, was blind from his youth. Theresa von Paradis, the noted pianist and composer, was blind from her childhood. Nicholas Sanderson, the successor of Newton in the chair of mathematics in the University of Cambridge, was blind from his infancy. Nicaise, of Mechlin, and Peter Pontanus, deprived of vision when they were but three years of age, won distinction in law and divinity, philosophy and literature. Margaret of Ravenna and Frances Brown lost their sight when but a few months old, but, notwithstanding this, they were able to attain to eminence in theology and morals, poetry and fiction. John Metcalf became blind at the age of six, and John Gough at the age of three, and yet the former was afterward distinguished as a road surveyor and contractor, while the latter became famous as a botanist and a natural philosopher. The Bohemian patriot, Zisca, was celebrated as a military genius, and, nevertheless, it is said of him that "he was

more dreaded by his enemies after he became blind than before."

But all the persons just named achieved success by the sheer force of genius. Mlle. Mulot has, by her invention, put it in the power of any one, possessing ordinary industry and perseverance, to accomplish what only those dowered with extraordinary talents and energy would otherwise attempt. She has given a spur to the ambition of the sightless, ennobled their aspirations, and fortified their courage. She has shown them that labor and determination may, at least in a measure, replace genius in the intellectual world, and that their privation, great as it may seem, is not without numerous and important compensating advantages. All honor, therefore, to her and to the generous and sympathetic friends who have so nobly seconded her efforts in her work of mercy and charity. May she live to see the system, which she has labored so assiduously to perfect, adopted throughout the world, and may she be permitted also to enjoy at least the recompense of appreciation which is so frequently, alas! withheld from the greatest of the world's benefactors!

CHAPTER X.

"THE OMAR OF THE NEW WORLD."

SOME years ago I spent the greater part of the winter in the City of Mexico. While there I made frequent visits to El Museo Nacional de Mexico—the national museum—which always possessed for me a peculiar interest. There is much in the museum to arrest the attention of any one interested in science, history, and archæology. It is especially rich in collections and records relating to the earlier inhabitants of the country, particularly the Toltecs and the Aztecs. Indeed, as a unique witness of the civilization and achievements of a people who were once as eminent as they are now obscure, I know of nothing to compare with the treasures of Mexico's great museum unless it be the collections of the far-famed museum of Bulak, in Cairo.¹ In both of these noble repositories are exhibited the relics of a civilization long past, of a people who, in their day, were the acknowledged leaders in art and science, and whose culture and genius, as attested by monu-

¹ Since the above was written the museum has been transferred to more commodious quarters; to-wit: to the large and beautiful Palace of Gizeh, in the outskirts of Cairo, and on the way to the great pyramids.

ments of all kinds, have excited the admiration of all subsequent generations.

In Bulak, thanks to the founder of the museum, the erudite and indefatigable Mariette Pasha, and to the labors of Maspero, Brugsch, Schweinfurth, and others, we have a glimpse of Nile-land as it was under the Pharaohs thousands of years ago. And in the hieroglyphics that cover the papyri, sarcophagi, blocks and slabs of stone therein collected, are provided the materials for a history extending from the time of the builders of the pyramids to the reign of the last of the Ptolemies. It is strange, but it is true nevertheless, that it is only within the last half century that a history of Egypt has been possible. The discovery of the Rosetta stone, and the deciphering of its mystic symbols by the immortal Champollion, opened, for the first time, the numberless treasure-houses, before practically valueless, of Egyptian lore and history. Now every inscription, every sphinx, obelisk, pyramid, temple, and sarcophagus, as well as every roll of papyrus, has its story to tell, and in language that can no longer be mistaken or misunderstood.

In the Egypt of the new world, as Mexico is often styled, there is much to remind one of the Valley of the Nile. The points of resemblance between the inhabitants of the two countries are numerous and striking. Both Egyptians and Mexicans of old were as superior in intellectual attainments to their neighbors and contemporaries, as

were the Greeks and Romans in advance of the barbarians by whom they were surrounded, and with whom they were in almost constant conflict. If Egypt was the cradle of science in the Old World, Mexico was the birth-place of knowledge in the New. There is, too, a similarity in the monuments of the two countries that, after the lapse of so many ages, excites the astonishment of the most casual observer. The pyramids of Gizeh and Sakkara have their analogues in those of Cholula and Teotihuacan. The stately temples of Thebes, Philae, Abydos, and Medinet-Abou are matched by the cyclopean edifices of Mitla and the architectural wonders of Palenque and Chichen-Itza, of Uxmal and Mayapan. The statues of the Pharaohs, from the giant sculptures of Rameses the Great, at Aboo-Simbel, to those that have been brought to light by recent excavations in the buried cities of the Delta; the sphinxes of Memphis as well as the monster near Cheops; the obelisks of Karnak and Heliopolis naturally suggest comparison with equally marvelous objects found in such profusion in Chiapas, in Oaxaca, in and about Tula, throughout the vale of Anahuac, and amid the rich and tangled forests of Yucatan. Among other conspicuous objects of Toltec and Aztec origin that have always attracted the attention of the learned are the celebrated calendar stone, formerly in the left wall of the Cathedral, but lately transferred to the museum; the great sacrificial stone on which so many myriads

of human victims were sacrificed in response to the behests of ignorance and superstition; the grotesque statues of Chac-Mool and Nehuazcoyotl, not to speak of others equally hideous and fantastic.

It would be outside the scope of this chapter to trace the many points of resemblance between the remarkable people of Ancient Egypt, and the equally remarkable race that held sway in Mexico previous to the arrival of Cortez. It were alike foreign to my purpose to institute anything like a detailed comparison between the relics and monuments still scattered all over these countries, or those collected in the two grand museums of Bulak and Mexico. Any one who has ever visited the two lands, or studied the treasures of the two collections referred to will be led, almost irresistibly, to seek resemblances and make comparisons, so strikingly are the genius and the character of the Egyptian reproduced in the Toltec and the Aztec.

But while pursuing my investigations in El Museo Nacional, meeting at every turn something that reminded me of the magnificent repository on the bank of the Nile, I was suddenly and painfully made aware that there was a difference in the *raison d'être* of the two collections. The chief, if not the sole, object of the museum of Bulak is to aid one in determining the history of the past. Everything, therefore, is presented in such a manner as to enable the student to arrive at a correct knowledge of facts. Nowhere, in this noble institution, will one be con-

fronted with anything that savors of prejudice or willful ignorance. I regret that I cannot say as much for the museum, or, rather, those in charge of the museum of Mexico. For reasons that unbiased investigators would hesitate to accept, the curator, Sr. Sanchez, has forced the museum to appear as a witness for the perpetuation of a falsehood, and for the fostering of a prejudice that should long since have been relegated to that limbo created for historical lies by modern criticism and exact research. I refer to the alleged destruction of the antiquities and hieroglyphical records of the country by the early missionaries, and notably by the first Bishop and Archbishop of Mexico, Fray Don Juan Zumarraga.

In looking over one of the official publications¹ of the museum, the first thing to arrest the attention of the reader is a historical notice of the institution, written by the professor of zoölogy, Sr. D. Jesus Sanchez. At the very outset of his account we find the following sentence: "When the fury of the first Archbishop, Zumarraga, and that of the conquerors and missionaries had exhausted itself in destroying the writings and monuments of the Aztecs, all such records being considered as an invincible obstacle to the abolition of idolatory and the establishment of Christianity among the conquered peoples, there came a more enlightened period, when people began to realize the irreparable loss which had been sustained by the New World." And, a little further

¹ "Anales del Museo." Tom. I., p. 47.

on, the same writer adds: "The kings of Spain endeavored, as far as possible, to repair the evil occasioned by ignorance and fanaticism."

Such sweeping statements, in a work that should give only unquestioned facts, are something, it will be admitted, that is calculated to provoke surprise, if not resentment. One expects to meet such charges in works of which the bias is manifest, and in which prejudice and bigotry are frequently the chief characteristics, but in an official contribution to science, like the volume of the "*Anales*" just referred to, a gross misstatement of fact can admit of no palliation whatever, unless it be the plea of invincible ignorance. It is but fair, however, to Sr. Sanchez to observe that, if ignorance in a historian could ever be pleaded as an extenuating circumstance for making a statement unsupported by evidence, the Mexican professor is entitled to be treated with leniency in the case under consideration. He had, without sufficient examination, accepted as true a charge which many historians had made against the illustrious prelate of Mexico, and had taken it for granted that he was dealing with a fact of authentic history.

My studies of Mexican history had convinced me that the indictment made against Bishop Zumarraga and his confrères was, like many other facts of so-called history, something that reposed on nothing better than a fabrication, pure and simple. However, to get further information on the subject, I deter-

mined to call on the distinguished Mexican historian, the late Sr. Don Joaquin Garcia Icazbalceta, as I knew that he was fully informed regarding the question, and could, better than any one living, refer me to all the authorities bearing on the subject.

Sr. Icazbalceta has accomplished for the history of Mexico what the lamented John Gilmary Shea did for the history of our own country, and what the erudite and painstaking Janssens achieved for that of Germany. Indeed, the many respects in which these three eminent men closely resembled each other were quite extraordinary. They all had a genius for history, and a memory for facts, and dates, and names which was simply phenomenal. All three devoted special attention to the history of the sixteenth century, and all were successful in bringing to the light of day numerous important documents that had long been buried in oblivion. The "*Bibliographia Mexicana del Siglo, XVI.,*" a voluminous collection of precious documents, edited and published for the first time, a few years ago, is a monument to the zeal and erudition of the distinguished Mexican author, of which Catholics throughout the world may justly feel proud. In this scholarly work, which is not so well known as it should be, one will find the best answer to the many erroneous statements made by superficial writers regarding the part taken by ecclesiastics in the work of civilizing and Christianizing the nations of New Spain.

On my calling on Sr. Icazbalceta I found that he

had just published a life of Bishop Zumarraga,¹ and that the work contained precisely the facts and information I was seeking. Indeed, so thoroughly has the illustrious author accomplished his task, that no one can pretend to an accurate knowledge of the subject under examination who has not read the chapter which discusses it *ex professo*, and, in such wise, as to terminate forever all further controversy.

The charge made by Sr. Sanchez in the "Anales del Museo" has been repeated by English and American writers with all the variations of which bigotry and prejudice could render it susceptible.

Robertson in his "History of America" ² says: "The obscurity in which the ignorance of its conquerors involved the annals of Mexico was augmented by the superstition of those who succeeded them. As the memory of past events was preserved among the Mexicans by figures painted on skins, on cotton cloth, on a kind of pasteboard, or on the bark of trees, the early missionaries, unable to comprehend their meaning, and struck with their uncouth forms, conceived them to be monuments of idolatry, which ought to be destroyed, in order to facilitate the conversion of the Indians. In obedience to an edict issued by Juan de Zumarraga, a Franciscan monk, the first Bishop of Mexico, as many records of the

¹ "Don Fray Juan de Zumarraga, Primer Obispo Y Arzobispo de Mexico, Estudio Biographico y Bibliographico, por Joaquín García Icazbalceta ; Con un Appendice de Documentos Ineditos Raros, Mexico;" Antiqua Libreria de Andrade y Morales, Portal de Agustinos. No. 3, 1881.

² Book. vii, near the beginning.

ancient Mexican story as could be collected were committed to the flames. In consequence of this fanatical zeal of the monks who first visited New Spain, which their successors soon began to lament, whatever knowledge of remote events such rude monuments contained was almost entirely lost; and no information remained, concerning the ancient revolutions and policy of the empire, but what was derived from tradition, or from some fragments of their historical paintings that escaped the barbarous researches of Zumarraga."

Such a theme, as one might anticipate, was a grateful one to a writer like Prescott. It enabled him to give full rein to his fancy and afforded him a better opportunity of venting his spleen against the monks and the Church than any other subject connected with the history of the conquest. We are not surprised, therefore, when we read his very highly colored account of the rôle which he attributes to the bishop in the destruction of the manuscripts of the nation's archives.

"At the time of the arrival of the Spaniards," writes Prescott, "great quantities of these manuscripts were treasured up in the country. Numerous persons were employed in painting, and the dexterity of their operations excited the astonishment of the conquerors. Unfortunately this was mingled with other unworthy feelings. The strange, unknown characters inscribed on them excited suspicion. They were looked upon as magic scrolls; and

were regarded in the light with the idols and temples, as the symbols of a pestilent superstition, that must be extirpated. The first Archbishop of Mexico, Don Juan de Zumarraga—a name that should be as immortal as that of Omar—collected these paintings from every quarter, especially from Tezcuco, the most cultivated capital in Anahuac, and the great depository of the national archives. He then caused them to be piled up in a ‘mountain-heap’—as it is called by the Spanish writers themselves—in the market-place of Tlatelolco and reduced them all to ashes. His great countryman, Archbishop Ximenes, had celebrated a similar *auto-da-fé*, of Arabic manuscripts in Granada, some twenty years before. Never did fanaticism achieve two more signal triumphs, than by the annihilation of so many curious monuments of human ingenuity and learning. The unlettered soldiers were not slow in imitating the example of their prelate. Every chart and volume which fell into their hands was wantonly destroyed, so that when the scholars of a later and more enlightened age anxiously sought to recover some of these memorials of civilization, nearly all had perished and the few surviving were jealously hidden by the natives.”¹

Mr. Hubert Howe Bancroft reiterates the story in his voluminous but loosely put together work “The Native Races of the Pacific Coast.” The chief if not the only merit of Mr. Bancroft, as a historian,

¹ “History of the Conquest of Mexico,” Book I, ch. 4.

it may be remarked *en passant*, lies in the fact that his foot-notes, in which he cites his authorities, are apparently given with care and exactness, and that he has amassed a rare collection of manuscripts and other materials, which will always be of inestimable value to the student of history. In the subject under discussion he follows in the wake of Robertson and Prescott. And in lieu of stating dispassionately the facts of the case, he takes occasion as in numerous other places, in his many ponderous tomes, to deliver a violent declamation against monks and bishops, but, as with Robertson and Prescott, the special object of his bitter invective is Mexico's first prelate, Don Fray Juan de Zumarraga. He says:—

‘Unfortunately, the picture-writings, particularly those in the hands of priests—those most highly prized by the native scholar, those which would, if preserved, have been of priceless value to the students of later times—while in common with the products of other arts they excited the admiration of the foreign invaders, at the same time they aroused the pious fears of the European priesthood. The nature of the writings was little understood. Their contents were deemed to be for the most part religious mysteries, painted *délices* of the devil, the strongest band that held the people to their aboriginal faith, and the most formidable obstacle in the way of their conversion to the true faith. The destruction of the pagan scrolls was deemed essential to the progress of the Church, and was consequently

ordered, and most successfully carried out under the direction of the bishops and their subordinates. The most famous of these fanatical destroyers of a New World's literature being Juan de Zumarraga, who made a public bonfire of the nation's archives. The fact already noticed, that the national annals were preserved together in a few of the larger cities, made the task of Zumarraga and his confrères comparatively an easy one, and all the more important records, with very few probable exceptions, were blotted from existence. The priests, however, sent some specimens, either originals or copies, home to Europe, where they attracted momentary curiosity and were then lost and forgotten. Many of the tribute rolls, and other paintings of the more ordinary class, with, perhaps, a few of the historical writings, were hidden by the natives and thus saved from destruction."¹

When one learns that Prescott was a friend and a correspondent of Icazbalceta, as is also Bancroft, and that both the one and the other, the latter especially, were in a position to get reliable information concerning the question with which we are now engaged, one must feel that there can be but very little excuse for their misrepresentations of the facts of history. They allowed themselves to be carried along with the current, because it afforded them a rare opportunity to indulge in a rhetorical harangue against persons and institutions with whom and with which they were not in sympathy, and be-

¹ "Native Races of the Pacific Coast," vol. ii, p. 527.

cause their natural bias, and preconceived notions, which are ill concealed, led them to cling to a fiction, rather than accept an authentic statement of fact which Sr. Icazbalceta was in a position to furnish on demand.

But, it will be urged, even the illustrious Humboldt rehearses the same charges as do the writers just quoted.¹ This is true, but it only goes to show how difficult it is sometimes, even for a great mind, one earnestly seeking after truth, to avoid being swayed by prejudgments and to steer clear of error; how almost impossible it may be to disentangle truth from the mazes of falsehood, when a determinate statement or proposition has been given a similitude of truth by dint of constant repetition from generation to generation. The saying, "Lie, lie, something will stick," is particularly applicable to the case in point, and shows how easy it is, not only to distort the facts of history, but to put in circulation errors and falsehoods that it may require centuries to eradicate.

We have given extracts from only a few writers, all of whom are well known and recognized by the general public as standard authorities on the subjects which they respectively treat. Sr. Sanchez, in support of his thesis, quotes no fewer than eighteen

¹ "In his '*Vues des Cordillères*,' p. 26, Ed. in folio, he says, '*Lorsque l' évêque Zumarraga, religieux Franciscain, entreprit de détruire tout ce qui avait rapport au culte, à l' histoire et aux antiquités des peuples indigènes de l' Amérique, il fit aussi briser les idoles de la plaine de Micoatl.*'"

authors, most of whom wrote in Spanish. Among the best known and most distinguished of these are Motolinia, Sahagun, Duran, Padilla, Herrera, Torquemada, Ixtlilxochitl, Clavijero and Alaman. Sr. Icazbalceta, however, goes much further. In addition to the authorities adduced by Sr. Sanchez he cites and critically examines the testimony of fifteen others, whom Sr. Sanchez had not consulted, or whom, at least, he does not mention in his "*Reseña Historica*." Among these may be named Mendieta, Cavo, Veytia, and the Italian traveler, Gemelli Careri. Sr. Icazbalceta thus summons before his tribunal no fewer than thirty-three witnesses, embracing all the more noteworthy writers on the question at issue, from Mr. Bancroft, the latest traducer of Bishop Zumarraga, to Pedro de Gante, who wrote in 1529. Examining each author in turn, beginning with Mr. Bancroft, he goes back to those who first gave currency to the charges which have so long obtained against the venerable prelate of Mexico. Some of the more modern witnesses he dismisses forthwith, because they fail to adduce the authorities on which they base their statements. Others he rejects because they are manifestly so prejudiced and so actuated by antipathy and passion that they are disqualified from testifying. Others still are excluded, because in citing their authorities, they give the judge an opportunity of weighing the testimony as presented by the primitive authors. After a brief but searching examination, in which

the judge surprises us at every step by his keen analytical treatment of the case no less than by his marvelously comprehensive knowledge of all the facts bearing on the question, he reduces the number of those competent to testify from thirty-three to thirteen. Twenty are at once pronounced incapable of giving evidence, either on account of strong prepossessions adverse to the accused, or because they simply repeated what had been stated by others before them.

These thirteen authors Sr. Icazbalceta divides into three classes according as they speak of the destruction of temples, or idols, or picture-writings. The reasons that prevailed for the destruction of temples or idols were not the same as those that would lead to the destruction of picture-writings, nor were the consequences flowing from such destruction the same in the three cases. Again, each one of these three divisions is subdivided into two others, the first embracing those authors who speak of the bishop, and the second comprising those whose evidence relates to others, missionaries or not.

The destruction of the *teocallis*, or pagan temples, was a religious and a military necessity. The missionaries came to convert the Indians, and to bring them to a knowledge of the true faith. But they could have accomplished little or nothing if the natives had been left in undisturbed possession of their ancient places of worship. The pagan priests, who far outnumbered the missionaries, could under such cir-

cumstances have counteracted without effort all the results that could have been achieved by the ministers of the Gospel. The only thing, therefore, to be done, unless the work of Christianizing the Indian was to be rendered futile, was to expel the pagan priests from their temples, and to prevent their return by razing the temples to the ground.

But even if the missionaries had not found themselves obliged to destroy the edifices dedicated to the worship of false gods and polluted by the blood of thousands of human victims, their destruction would still have been deemed an imperative necessity from a military point of view. Every *teocalli* was a fortress, and it was obviously an impossibility for a small handful of men to retain possession of the country for any length of time, if the Indians, who were but partially subdued, were allowed to retain what, in the event of revolt, would have been a most formidable means of offence and defence.

The peculiar form of the *teocallis*, being pyramids of earth or stone, surmounted by small wooden towers, and temples, was such as to preclude the possibility of converting them to uses other than those for which they had been designed. With the pagan temples of ancient Greece and Rome it was quite different. Their structure was of a character which admirably adapted them to the purposes of Christian worship. The simple blessing of the Church, was, therefore, all that was requisite to change them from habitations of Satan to the abodes of the true God.

Nevertheless the *teocallis* that were made of stone served one good purpose. They supplied material for the erection of churches and oratories. And the poor Aztecs, who had for generations been so inhumanly treated by their cruel priesthood, were only too glad to lend a helping hand toward demolishing the blood-stained edifices on whose altars had been sacrificed so many who were near and dear to them. The sacrificial stone, always reeking with human blood, was replaced by the altar of unbloody sacrifice, and the joyful bell, calling the people to prayer, was substituted for the mournful *teponaxtli*, whose lugubrious tones gave the signal for the slaughter of some new band of trembling and terror-stricken victims.

According to Motolinia, the work of demolishing the *teocallis* was begun January 1, 1525, in Tezcuco. But Bishop Zumarraga did not arrive in New Spain until December 1528, three years subsequently. He could, therefore, have had nothing to do with the destruction of the great *teocallis* in the capital, because this was decreed and effected by Cortez immediately after the taking of the city, and was one of the first things demanded before the task of rebuilding the city could be undertaken. The same may be said of the pyramidal temples in other places. The material of which they were constructed was required for the building of churches and chapels, and the majority of the *teocallis* were appropriated for this purpose before Bishop Zumarraga even set foot on

Mexican soil. In summing up the evidence bearing on the destruction of the *teocallis* Sr. Icazbalceta declares: "I do not know of a single trustworthy document by means of which it can be proved that Bishop Zumarraga ever laid hands on a single temple." ¹

If there were reasons for the demolition of temples, there were still stronger ones for the annihilation of idols. In no other way could the Indians be effectually withdrawn from their heathenish customs and practices. And considering the incredible number of idols which were found everywhere, their total extirpation was no inconsiderable task. They were met with at every turn—in the house, in the garden, in parks and in forests, on the mountain top, and in places where one would least expect to find them. Indeed so loath were some of the natives to part with their fetiches that, for surer safe-keeping, they concealed them at the foot of crosses and crucifixes.

Some writers, among them Clavigero, have affected to believe that the objects of worship of the Indians should have been preserved in museums for the benefit of students of a subsequent age. Such action would have been sheer folly, aye, worse than folly, madness. What interpretation would the Indians have put on such a procedure? Only one, and that, to them, the most natural one. They would have regarded the preservation of their idols,

¹ Op. cit., p. 346.

and the appointing of persons to take care of them, as a certain indication that the Spaniards themselves considered them as so many deities and would, accordingly, have construed any evidence of appreciation into an act of worship. The only course, therefore, left open to the missionaries, if they were to convince the Indians that their preaching was in accordance with their practice, was for them to be consistent. It was necessary for them to show their abhorrence of every form of idolatry, and to demonstrate to the benighted pagans that their idols could be treated with every kind of indignity, and broken into fragments, without the slightest fear that such actions would bring down upon the heads of those who dared such things the wrath and avenging thunderbolts of some outraged god. Hence idols wherever found, were overthrown. They were often, moreover, ignominiously cast into the fire, and thus treated as the meanest of criminals. They were defaced and broken and subjected to every species of contumely, until the Aztec had learned the lesson, which could not have been taught him so well in any other way, that his idols were as powerless to aid him as they were to help themselves, and that, far from being regarded as objects of worship, they were to be treated with contempt and reprobation.

And what share had Bishop Zumarraga in this justifiable destruction of idols? Very little indeed. Nothing that was done before his arrival at the close

of the year 1528 can be attributed to him. It is true that he gave orders that the idol of Teotihuacan should be precipitated from the high position which it occupied. A century later Gemelli found it broken in three pieces at the foot of the pyramid on which it had been located. Had there been any reason for preserving these pieces they could even then, easily have been reunited, and the idol would have been restored to its original form.

But aside from this solitary case, in which the bishop simply performed his duty, there is not another instance that can be cited where he is known to have taken an active part in the destruction of idols. Ixtlilxochitl indeed accuses him of having destroyed the bas-relief of Tezcotzinco, but then, as we shall learn, the testimony of this writer is open to suspicion, and often deserving of little or no credit whatever. Padilla also holds him responsible for defacing the figure of a coyote, sculptured in the solid rock, on the summit of a certain mountain. The last two charges, however, are so vague in their character, and the testimony, of at least one of the witnesses, so unreliable, that they both can be dismissed without further comment.

Pass we now to the alleged destruction of manuscripts, or picture-writings. Of the thirteen authors, out of the thirty-three, whose testimony Sr. Icazbalceta deemed worthy of examination, six must now be excluded, as they speak solely of the destruction of temples and idols, and make no allusion to that

of pictures or manuscripts. Only seven are now left, and of these seven we need consider but two, Torquemada, and Ixtlilxochitl. The former is the first to attribute to the bishop the burning of manuscripts, but he says nothing of the archives of Tezcuco. It is of the latter writer that I shall have most to say, as he it was who originated the story regarding the extent and magnificence of the treasures preserved in the archives of Tezcuco. And as it is on the wholesale destruction of these archives that most stress has been laid, especially by modern authors, I shall, without further preamble, make a few brief observations regarding the character of Ixtlilxochitl as a historian, and inquire how far he merits our confidence in his statements anent the question now under investigation.

Don Fernando de Alvo Ixtlilxochitl, who wrote between the years 1600 and 1615 or 1616, over fifty years after the death of Bishop Zumarraga,¹ was a descendant of the kings of Tezcuco. Having been reduced to straightened circumstances, he deemed it politic, in order to interest the Spanish Government in his behalf, to exaggerate the glory of his ancestors and the splendor of their achievements in war and peace. According to him, Tezcuco was "the Athens of Anahuac; her king, the glorious descendant of the great Chichemecan monarchs, was the oracle of the kings of Mexico; the one

¹ The venerable prelate died June 3, 1548, at the age of more than four score years. The exact date of his birth is unknown.

whose voice was raised in council and who was always consulted in difficult cases. There the Mexican language was spoken in its greatest purity; there literature was cultivated, and there likewise were preserved all the treasures of science and wisdom of the race. In Tezcuco were schools of poetry and music, of oratory and philosophy. Her temples and palaces and gardens surpassed in beauty and magnificence those of the great Tenochtitlan. He even goes so far as to assert that the kings of Mexico were tributary to those of Tezcuco."

If we now turn to another Aztec historian, Tezozomoc, we shall learn that the king of Tezcuco was nothing more than the first feudary of the Emperor of Mexico. We are told that the splendor of the Mexican court was unsurpassed and that the power of her rulers admitted neither division nor rivalry.

Which of the two authors shall we credit? For our present purpose the answer is immaterial. If we refuse to believe Ixtlilxochitl when declaring the existence of the archives, whose value he so highly extols, we need go no further, as that could not have been destroyed which did not exist. If, however, we credit his assertions about the existence of such archives, we must also accept his statements, when he declares, as he does in two different passages, that the Tlascalans, when they entered Tezcuco, in company with Cortez, set fire to "the principal palaces of king Nezahuilpilli in such wise that they burned *all* the royal archives of *all* New Spain,

and the memories of her antiquities perished from that time."

The entrance of Cortez at the head of his army, into the city, was effected the last day of the year 1520. Eight years subsequently, Bishop Zumarraga came to Mexico for the first time. "What Tezcucan archives did he then burn, if they had already been *all* destroyed? Did he perchance set fire to the ashes of the papers previously burned by the Tlascalans?"

But we have not yet discovered the author of the story imputing to Bishop Zumarraga the burning of the archives of Tezcuco. Who was he? When did he live? What is his standing as an authority on the question? Neither Ixtlilxochitl nor Clavigero, nor any of the earlier writers ascribe to the bishop this Omar-like act of vandalism. Who, then, is the author of the fiction?

Incredible as it may appear, the story was first fabricated towards the close of the last century by a certain writer by the name of Mier¹, nearly three centuries after the event is alleged to have occurred. Mier's friend and companion Don Carlos Bustamante, took up the fabrication and, adding to it a few touches

¹ His words, as quoted by Icazbalceta, p. 317, op. cit., are "Al primer obispo de Mexico se le antojo que todos los manuscritos simbolicos de los indios eran figuras magicas, hechicerias y demonios, y se hizo un deber religioso de exterminarlos por si y por medio de los misioneros, entregando a las llamas todas las librerias de los Aztecas de los quales solo la de Tezcuco, que era su Atenas, se levaba *tan alta como una montaña*, cuando de orden de Zumarraga la sacaron a quemar."

of his own, gave it a circulation that it has retained until the present time.

Both Mier and Bustamente had a special grudge against Spaniards and bishops. In the estimation of the former, Bishop Zumarraga was guilty of three unpardonable sins. He was a Spaniard. He was a monk. He was a bishop.

Anyone that has read aught of Mier is not surprised at his having invented such a fable as the one in question. He was fully capable of this and much more, as his writings evince on almost every page. But fortunately for the cause of truth and justice both Mier and Bustamente have at last received their deserts. Their unscrupulous tampering with the facts of history has been discovered, and they now stand with all impartial readers as utterly discredited. A Nemesis, just and certain, has overtaken them, and both the authors and their works have been summarily consigned to the dark and pitiless waters of Lethe.

But, it will be insisted, if Bishop Zumarraga did not burn the archives of Tezcuco, because they were not in existence at his time, he was guilty, nevertheless, of what was equivalent to this in destroying all the picture-writings on which he could lay his hands.

We come again to a question of fact. Did the bishop do what his accusers maintain he did, or is he to be pronounced innocent of the charge so often preferred against him?

The only evidence which can be produced to

substantiate this last charge is that which is based on a letter, written by the bishop himself, to the general chapter of Tolosa, held in June, 1531. In this letter, that has given rise to much disputation, occurs the following sentence: "*Baptizata sunt plusquam ducenta quinquaginta millia hominum; quingenta deorum templa sunt destructa, et plusquam vicies mille figuræ dæmonum, quas adorabant, fractæ et combustæ.*"¹

The whole controversy here, as will be seen at a glance, turns on the meaning of the words "*figuræ dæmonum.*" The earlier writers understood them to signify false gods or idols, and Sr. Icazbalceta contends that this is the only meaning which history and sound criticism will permit one to assign them. Those, however, who take the opposite view argue that "*figuræ dæmonum*" must refer to picture-writings because of the word *combustæ*—burnt—which, they maintain, could not apply to such incombustible materials as idols of stone. These objectors forget that there were idols of paper and wood as well as of stone. They lose sight, too, of the fact that even those of stone were not infrequently covered with cloth and other inflammable material, and that it was a common occurrence to cast stone idols into the fire, to show thus the execration in which they should be held, and then break them in pieces afterward.

¹Various copies of this letter, in Latin and in Spanish, are given in the valuable appendix of Sr. Icazbalceta's learned monograph.

Such being the case, what becomes of the indictment so often brought against the venerable prelate concerning the part he is reputed to have taken in the destruction of the records of the country of his adoption? The words of the letter just quoted cannot, as we have seen, bear the interpretation so often put upon them by the bishop's vilifiers. The testimony of Ixtlilxochitl, so frequently adduced, is of no value. That of his contemporary, Torquemada, rests on only vague surmises, and on the artful fabrications of certain Indians—*Indios embusteros*, Icazbalceta styles them—whom the Spanish historian employed as interpreters, and who, to conceal their ignorance, and to further their own designs, intentionally led him into many and grave errors. Mier and Bustamante—the fathers of the story about the burning of the “mountain-heap” of precious documents which Prescott so laments—are, for reasons already given, entirely ruled out of court.

Sr. Icazbalceta's answer to the question just asked is short and to the point. “There is,” he says, “no *certainty* that there is due to Bishop Zumarraga the destruction of a single picture.”¹

We might securely rest our case on this positive and emphatic declaration of the distinguished historian. But the desire completely to vindicate the character of the much-maligned bishop impels me to make a few more observations concerning himself and his associates.

¹ Op. cit., p. 364.

It betrays an utter ignorance of the life and achievements of the man to refer to him, as so many have done, as an ignorant vandal, a fanatical iconoclast, the Omar of the New World, as one actuated by "brutal, superstitious, and voluntary ignorance"—these are Bustamente's words—for nothing could be farther from the truth. Even Sr. Sanchez is forced to acknowledge that the bishop was a man of great energy and humility, a personage of exalted virtue and apostolic zeal, and the valiant defender of the Indian, to whom he was ever a friend and a father.

Bishop Zumarraga, as his biographer demonstrates, was, without peradventure, a man who would have reflected honor on any country and on any age. As an ecclesiastic, he will compare favorably with the most eminent of his countrymen. As a statesman, he won the confidence of the rulers of Spain, and commanded the respect and admiration of the government authorities in the land of the Aztec.

He was, in every sense of the word, the shepherd of his flock. He was their defender against their oppressors, and their benefactor in sickness and distress. At his own expense, he erected hospitals and asylums, and made provision for the widow and the orphan. He built schools and colleges for the education of the natives, and endeavored, by every means in his power, to secure for them all the benefits of a Christian civilization.

That he might be able to carry on more effectually and more expeditiously the work of instructing

the Indian, he sent to Spain for a printing-press, and had established in his episcopal city, under his immediate supervision, the first printing-office in the New World. On this press were printed books in both the Spanish and Mexican languages, and the number of works published during the lifetime of the far-seeing prelate would be a matter of astonishment to those who have been taught to regard him as a narrow-minded, ignorant monk.

Besides having others write for the instruction of his people, he wrote much himself. Indeed, some of the most useful and most popular works then published were from his facile and prolific pen. They were mostly plain expositions of Christian doctrine, and were admirably adapted to the capacity of those for whom they were intended. They were characterized by a simplicity, directness, and persuasiveness which gave them a power for good that few similar works have ever possessed in such an eminent degree. He may not, indeed, be ranked among the classic authors of Spain; he had not the elegance of diction of Fray Luis de Granada, but he had the faculty of expressing the saving truths of the Gospel with a force and an unction that appealed to the heart as well as the intellect, with an effect which was almost irresistible. Even to-day some of his works might be read with nearly as much profit and edification as when they were first published.

And with all his other cares he found time to organize and develop many new industries that were

destined soon to contribute materially to the public weal. He caused to be brought from Spain the most valuable kinds of fruit trees, and had them planted where he thought they would thrive best. He fostered sericulture, and the manufacture of silk, and so great was the amount produced that it soon became an important article of commerce. The same may be said of the cultivation of flax and the production of linen. He also caused to be imported such domestic animals as were judged to be most useful to his people. To teach the Indians various trades, and to familiarize them with European methods of agriculture and manufacture, he invited laborers and artisans from Spain, and brought them to Mexico at his own expense.

As a Churchman he recalls to our minds St. Thomas of Villanova, and St. Isidore of Seville. As an administrator, there was much in him that gave such *éclat* to the career of his illustrious countryman, Cardinal Ximenes. As a statesman and a diplomat, obliged to deal, at one time with the Emperor, at another with the viceroy, and again with councils and chapters without number, he exhibited all the sagacity and enterprise and comprehensiveness of view which so distinguished Richelieu, without, however, displaying any of those qualities which have made the great cardinal the object of so much adverse criticism.

And, yet, it is this man, who did so much to ameliorate the condition of the Indian and to elevate

him to a higher plane; who was an energetic promoter, if not the organizer, of every movement that tended to develop the resources of the country; who contributed so much to the dissemination of knowledge among the masses, and labored so assiduously and successfully in the cause of higher education; whose whole life was marked by a spirit of enterprise, liberality and broadmindedness which always distinguish genuine greatness—it is this man, the honor of his age and country, and the benefactor of his race, that certain prejudiced and superficial writers would have us believe was an ignorant, fanatical monk; whose sole mission was to keep the world in ignorance, and whose highest ambition was the aggrandizement, even at the sacrifice of honor and principle, of the community to which he belonged, and the Church of which he was a representative. Well one might exclaim with the Roman orator, "*O tempora, O mores!*" But, thank God, the light of truth is beginning to break in upon the obscurity that has so long prevailed, and that has so long prevented one of the noblest of men from being seen and known in his true character.

What has been said of Bishop Zumarraga regarding the part he took in the destruction of the nation's archives, and of precious manuscripts, can also, in great measure, be iterated of his associates, the monks and priests who were his coadjutors in the work of evangelizing the Indian.

They are accused of having destroyed historical

records that would now be of priceless value. But no one, even when challenged to do so, has ever yet stated what was destroyed, when, or by whom. It is sufficient here to affirm that the charges made against the early missionaries have been grossly exaggerated. In many respects the charges are demonstrably false. For reasons, which at the time were deemed justifiable, they did, indeed, it may be admitted, destroy some picture-writings, but when they discovered their mistake, they made ample reparation for all the losses they had occasioned,

It is obviously not my purpose to make an apology for the missionaries for having destroyed idols and pagan temples. They would have been derelict in one of their first duties if they had done otherwise. Neither is it my intention to minimize the importance of some of the records which have disappeared, nor to undervalue anything that would throw light on the history of Mexico before the Conquest. But I must enter an emphatic protest against holding innocent men responsible for what they never did, or even thought of doing — what they could not have done even if they had been so minded.

It is a notorious fact that the picture-writings of Mexico had suffered serious losses even before the missionaries had touched the shores of the country. Sahagun relates the destruction of such records by the Indians in the time of King Izcoatl. Pomar, as well as Ixtlilxochitl, recount the burning by the Tlas-

calans of the archives of Tezcucó. In order to gain possession of the city of Mexico, Cortez found himself compelled to demolish the greater part of it, including the *teocallis*. With this wholesale devastation of the Capital disappeared many, if not most, of the annals therein preserved. Add to these three great causes of destruction, with which the missionaries, and much more Bishop Zumarraga, had nothing to do; the various losses incident to the long and protracted wars that desolated the country, as well as those which were entailed by neglect and the ravages of time, and we shall find that, at the period of the arrival of the missionaries, there was not much left for them to destroy, even if they had been so inclined.

Certainly there were no longer in existence those "mountains of manuscripts" which fanciful writers tell us of, which, according to Don Ignacio Cubas, were sufficient to feed the flames of a large bonfire for *three months*. Neither have we any reason for believing that these documents possessed that intrinsic value attributed to them by Sr. Cubas, still less that there were consigned to them invaluable secrets and discoveries which were unknown to civilized Europe. Historians of the Draper stamp are wont to claim the beginnings in every art and science for the mystical and much-overrated Arabs of the Middle Ages. Sr. Cubas, as his writings evince, does not hesitate to make a like claim for the unknown and overlauded annalists of ancient Mexico.

On reading his description of the great bonfire, one would imagine that Sr. Cubas was an eye-witness, so detailed is his account, instead of a chronicler, who lived full three centuries after the date to which the event is assigned. And so precise is the information he vouchsafes us regarding the contents of the manuscripts consumed by the flames that we should infer that he had at hand a catalogue of all the libraries then and there destroyed. But the careful student of history will find that the statements of Cubas, unsupported, as they are, by any reference, are no more deserving of credence than the assertion of Robertson regarding the *special edict* of Bishop Zumarraga, ordering the destruction of the nation's archives, an edict which Icazbalceta does not hesitate to state no one has ever seen, for the simple reason that it was never issued.

It has been averred that the missionaries made ample reparation for any losses of which, through inadvertence or lack of information, they may have been the cause. Indeed, all the knowledge that we now possess regarding the history of ancient Mexico we owe to them. They were the first to learn the languages of the peoples with whom they came in contact; the first to collect and preserve what was left of the past history of the nation; and the first to interpret and translate the picture-writings, and thus make them available for students and historians of a later age.

But yet more. It must not be forgotten that the

only value which Mexican picture-writings now possess is that given them by the works of the much abused monks and ecclesiastics who lived and labored in Mexico immediately after the Conquest. Without their writings, the hieroglyphical records of Mexico would be as unintelligible as were those of Egypt before the grand discovery of Champollion. It is easy for plagiarists and sciolists of a subsequent period to cast reproach on the missionaries who labored during the first century after the settlement of Mexico by the Spaniards, but it must be borne in mind that it was these same missionaries, and they alone, who have given us the key to the interpretation of the native records, and that they it is who have supplied us with all the materials of the nation's history which are now at our disposal. Without their contributions the history of Mexico before the advent of the Spaniards would be impossible, and we should to-day know little more of the country and its early inhabitants than is now known of the Mound-Builders of Ohio and Illinois, or of the Cliff-Dwellers of Arizona and Colorado.

To recapitulate: Thanks to the masterly "*Estudio Biographico y Bibliographico*" of Sr. Icazbalceta, whose argument I have endeavored to present as clearly as possible in the foregoing pages, we are now able to view the life and character of the venerable pioneer bishop of Mexico in their true light. Far from being an ignorant and fanatical iconoclast, the destroyer of a nation's records, and the treasures

of a new world's literature, he was one of the most intelligent, progressive, and generous spirits of his own or of any age. This is proved to demonstration by every act of his episcopal career.

That Bishop Zumarraga destroyed even a single temple there is no evidence whatever. Had he done so, no reasonable man could find fault with him, as the reasons for their destruction were, as we have seen, numerous and imperative.

Authentic history tells us of only one idol, that of Teotihuacan, destroyed in direct pursuance of his orders. No doubt many others were destroyed with his knowledge and approval. It would be a strange thing, indeed, to see a Christian bishop in a pagan country so far forgetting his primal duty as to not remove the worst stumbling-blocks standing in the way of the people's entrance into the Fold of Christ. But we are speaking not of a question of duty, but of a question of fact. Had not the work of demolishing temples and destroying idols been well under way, if not almost completed, before the bishop's arrival, there can be no doubt that he would have done his duty as intrepidly and as thoroughly as it had been performed by those who were in the field before him.

As to "the great rock of scandal," as Sr. Icazbalceta calls it, the destruction of the national archives, there is no certainty that the bishop ever destroyed, directly or indirectly, a single manuscript. No one ever charged him with having done so until

over half a century after his death. It was then, when all who had known the venerable prelate were dead, and when, consequently, no one could rise up to contradict their statements, that Torquemada and Ixtlilxochitl published those libels, and originated those calumnies which have constituted the foundation of all those bitter invectives and envenomed diatribes which have so long been directed against one of the best and noblest of men. Excluding the testimony of the two authors just mentioned, because, as we have learned, it is impeachable on so many grounds, every presumption is in the bishop's favor. His earnest and persevering efforts in behalf of education, the establishment, shortly after his arrival, of a school in his episcopal city for the interpretation of picture-writings, the personal interest he manifested in everything that related to the history and traditions of the aborigines, as is evinced, among other things, by his *Memoria* to the Council of Trent, concerning the antiquities of New Spain, all go to demonstrate that Bishop Zumarraga was, in sentiment and in action, the very opposite of what he is represented to have been by a certain class of writers whose *dicta* have been accepted, almost universally, as the incontrovertible facts of history.

"Sound criticism," says Sr. Icazbalceta, in concluding his elaborate investigation—and I am glad to terminate this long article in his own words—"can no longer permit the repetition of these absurd

charges against the missionaries, and, in particular, those against Bishop Zumarraga. The one who still persists in maintaining such an absurdity simply declares how superficial have been his studies, and how completely he is under the dominion of passion."

CHAPTER XI.

THE SITE OF THE GARDEN OF EDEN.

WHERE was the Garden of Eden located? Where was the seat of Paradise? In what quarter of the globe are we to look for the cradle of our race? These are questions that have been asked again and again, time out of mind. Philosophers and theologians, historians, archæologists, biologists, and zoölogists, have taken them up and discussed them in bulky tomes, but none of the answers so far given have met with general acceptance.

A special human interest attaches to these questions, and hence the marked attention they have always received from both the learned and the illiterate. In them there is something that excites our curiosity, and stimulates the spirit of investigation as do few other subjects. They speak of the origin of humanity and of the beginnings of history than which nothing is more fascinating or mysterious.

The questions asked are three in number, but they are in reality one and the same. Paradise and Eden, for the purpose of this chapter, may be considered synonymous terms, and both may be looked upon as the mother-region of mankind. An answer,

therefore, to any one of the questions propounded, will be for most persons, for all believers in the Bible assuredly, a response to all three, and what is said of one may, in great measure, be iterated, and with equal truth, of the other two.

At the very outset we are surprised by the diversity of opinions that have obtained regarding the site of the Terrestrial Paradise, and the various points of view from which it has been considered. A collection of the various notions that have prevailed, and of the opinions that have been defended, would form an interesting contribution to our literature, and illustrate some strange phases in the development of human thought. It would, indeed, be difficult to find anything more curious or instructive, or that better exemplifies how hopelessly at sea scholars may be regarding a subject which, at the first blush, would seem to admit of at least an approximate, if not a definitive, solution.

Some of the earlier commentators of the Scriptures, Philo-Judæus, Origen, and the majority of the Alexandrine School viewed Paradise in a mystical and allegorical rather than in a literal sense, although they did not deny the existence of a real Paradise in a geographical sense. According to Philo, it typified virtue, whilst according to Origen it was a picture of the soul or of heaven. In their view Paradise was not terrestrial, but celestial; the trees spoken of were not trees, but angelic virtues; the rivers mentioned were waters of grace; the delights

of the garden were the peace and happiness which are fruits of innocence. By many the Paradise described by Moses was regarded as identical with that spoken of in the New Testament, and it was accordingly located in a mysterious region intermediate between heaven and earth, but belonging to both.

Many modern exegetists, especially among those belonging to the rationalistic school, or the school of the "Higher Criticism," go much farther than the interpreters of the Alexandrine School, and deny *in toto* the existence of the Garden of Eden as described by the author of Genesis. According to their view, the stories of Eden and Paradise are but myths which are no more deserving of credence than are those of the Greeks, Hindus, and Persians, respecting the Isles of the Blessed, Mt. Meru, and Haraberezaiti. To them the Garden of Eden is but the Hebrew analogue of the Elysian Fields, the Gardens of the Hesperides, the Fortunate Isles of the Greeks; the Asgard of the Scandinavians, and the Kwen-lun of the Chinese; all of which, we are told, are as truly mythological in character, and as devoid of foundation in fact as are the tales and legends of the peoples named in respect of their gods, demi-gods, and heroes.

To add to the doubt and confusion introduced by those who refuse to see in the Mosaic Garden of Eden anything beyond myth or allegory, certain representatives of modern thought come forward and tell us that science has demonstrated that there could not

have been such a place as the traditional Paradise, and that it could not have been the cradle of our race, for the simple reason that humanity has not, as is generally imagined, descended from a single pair, but from several pairs. The defenders of this theory, known as polygenists, assure us that the doctrine of the unity of species, to which the world has so long pledged its faith, is no longer tenable; that instead of being one, there are many species of man; and that they not only have no genetic connection with one another, but that they originate in different parts of the earth far remote from each other.

It is true, that polygenists are not agreed as to the number of the species into which the *genus Homo* should be divided, or what characters should determine the different species. It is, indeed, difficult to find any two who agree on these points. According to Virey there are but two species; Professor Louis Agassiz makes nine; Borey de Saint Vincent finds fifteen, while Desmoulins raises the number to sixteen.

By some anthropologists the races or species of men are divided according to the color of the skin or hair; by others according to the form and size of the skull; and by others still, according to the size of the facial angle. Again, men are grouped according as they may have straight or wooly hair, or according to the combined characters of the hair, cranium and complexion. It may here be remarked that as used by polygenists the terms races and spe-

cies are singularly vague and confused, and the lines of demarcation drawn by different authors are often as fanciful as their theories are grotesque.

Agassiz divides the earth into nine great regions or kingdoms, which were first peopled by men especially created for these different divisions of the globe. He would have it, however, that all these groups of mankind constituted but one species, although descending from different parents, but his opponents, in spite of all his protestations that he was a monogenist, insisted on it that he was a polygenist pure and simple.

At all events, whatever may have been the great naturalist's contention regarding the unity of the human species, his theory made for several points of origin for the human family instead of one, according to the traditional view. There were, therefore, not one but several cradles for humanity; several mother-regions for the progenitors of the countless tribes that now inhabit the world. This view, it is obvious, is entirely subversive of the Adamic origin of the human species, and denies by implication the truthfulness of the Genesiatic narrative respecting the Garden of Eden as the birthplace of humanity.

Quatrefages, however, has shown that this "theory which attaches a human race to every center of appearance as a local product of that center, ought to be rejected by anyone who sets the least value upon the results of observation."¹ How Agassiz,

¹ "The Human Species," p. 167.

with his vast knowledge, could give his name to a theory which is contradicted not only by zoölogy and anthropology, but also by ethnology and linguistics, has always been an enigma that many of his friends and admirers have found inexplicable.

Vogt, like Agassiz, contends for different centers of appearance for humanity, but, unlike the Cambridge professor, he is a staunch believer in the simian origin of man. Vogt is an ardent evolutionist, while Agassiz, to the day of his death, battled against evolution as a theory that was utterly at variance with both the facts of biology and paleontology. Agassiz was a believer in God, the Creator of all things, while Vogt ignores, if he does not deny, the existence of a personal Creator, for the reason, he tells us, that there is "no sphere of action for such a being." Not only, according to Vogt, are there manifold species of men indigenous to different and widely-separated regions of the earth, but these species are the descendants of certain anthropoid apes, of certain "missing links," connecting man with the baboons and monkeys of the Old and New Worlds. American races of men, he will have it, are derived from American apes, Negroes from African apes, Negritos from Asiatic apes.¹

Hæckel agrees in the main with Vogt in his evolutionary views respecting the simian origin of man,

¹ "Lectures on Man," London, 1864, p. 467. In his "Memoire sur les Microcéphales," however, the Genevese naturalist carries back the genealogy of man to *one* primeval ancestor.

but inclines to monogenism rather than polygenism. The professor of Jena denies, however, that there was ever, strictly speaking, a first man, or a first pair, from which all the races of men are descended. Man's first ancestor, far from being the perfect man depicted by Moses or Milton, was but a simple speck of protoplasm, in the form of an humble moneron or amoeba, which made its appearance on our planet not a few thousands of years ago, but many millions, yea many "milliards of thousands of years ago." He sketches out the genealogy of our race through twenty-two typical, transitional forms; some of which have never had any existence outside of Hæckel's fertile brain, and asks us to accept his fantasies as the latest results of veritable science. He differs from many of his colleagues in advocating but one centre of appearance for mankind. In this respect, at least, he is at one with those who hold the unity of origin of the human species, although the common ancestor of the various races of men, according to Hæckel, is much further separated in time from those who now inhabit the earth than is Adam, the traditional father of our species. Hæckel's Paradise — he puts an interrogation mark after Paradise, which is rather singular in one who is always so positive in his statements — is located in a hypothetical continent at the bottom of the Indian Ocean. From this submerged continent, of which Wallace declares there is no good evidence, Hæckel would have us believe, are derived the various races

and tribes of men who now people the Old World and the New. Lemuria, then, according to Hæckel takes the place of the Garden of Eden as described in Genesis, and an insignificant amœba replaces the Scriptural Adam as the progenitor of mankind!

Without entering into details it is sufficient to observe here that the theories of Agassiz, Vogt, and Hæckel are very far from meeting with general acceptance. There is no evidence whatever either in favor of polygenism or of the simian origin of man. On the contrary, the more closely the subject is investigated, the more carefully all the facts bearing on the case are scrutinized and compared, the more inevitable becomes the inference in favor of monogeny.

The ablest exponents in every department of science have been and are defenders of the doctrine of the unity of the human species. Linnæus, Buffon, Cuvier, the two Geoffroys, Humboldt, Johann Müller, Quatrefages and Mivart have, from purely scientific data, demonstrated that all the evidence, so far adduced and collated, proves, in the most unmistakable manner, that there is but one species of man, and that the teaching of science regarding the specific unity of mankind is identical with that of Scripture. Polygenism, therefore, may be dismissed as an hypothesis which is not only untenable, but as one which is not sustained by any of the sciences which are appealed to in its defence. With truth

then does Winchel declare "the plural origin of mankind is a doctrine now almost entirely superseded."¹

Even so ardent a polygenist as the distinguished linguist, Pott, of Halle, is compelled to affirm, "I must declare, although with regret, that there is nothing in philology which is directly opposed to the derivation of all men from a single primitive pair, and the prospect of one day demonstrating such origin by decisive arguments drawn from linguistics cannot be ignored." For this and other similar reasons, which it were easy to adduce, we may consider the unity of the human species as one of the accepted teachings of science as well as one of the admitted dogmas of general Christian belief.

What has been said of polygenism may likewise be predicted of the theory of the animal origin of man. Not only is it not proven, but all positive evidence is decidedly against it. No "missing link," no pithecanthropoid, no *alalus*, connecting man with any species of catarrhine apes, or other irrational mammal, has yet been discovered, and, judging from the systematic and zealous, yet fruitless, search which has been made for such a link, in all parts of the world, we may safely conclude that it never will be forthcoming.

I make this declaration not because I have any prejudices against the theory of evolution as applied to plant life or to animals other than man, for I have none. Evolution is a theory which, like any other

¹ "Pre-Adamites," p. 297.

theory, must stand or fall according as it is supported or not supported by the facts on which it is supposed to rest. So far is it from being established that many of the most eminent authorities in contemporary science hesitate to give in their adhesion to the theory as currently taught. It is, indeed, a plausible and a fascinating theory, but is it warranted by a correct interpretation of nature? We might allow it to be or not to be. But even if demonstrated, it has nothing to do, so far as the evidence now stands, with the evolution of man. There is nothing in organic evolution properly understood that is irreconcilable either with Scriptural teaching or Christian orthodoxy. All statements to the contrary proceed from either scientific or hermeneutical myopia, or both together. For it is a notable fact that in the Mosaic account of Creation the word *bara*—to create from nothing—is used only three times, first in the creation of inorganic matter, secondly in the creation of animal life, and lastly in the creation of man, into whose face was “breathed the breath of life.” As far, then, as revelation is concerned, there is nothing in a theistic view of evolution which any orthodox Christian may not accept. On the contrary, far from being opposed to the theory that animal and plant life is developed and differentiated by the operation of natural causes, the words of the Sacred Text seem to imply it, if they do not express and corroborate it. But, be this as it may, whatever views we may entertain respecting

the evolution of plants and animals, we are still entitled to hold to the traditional belief that man is not only specifically one, but also that he was specially created with all his noble powers of mind and soul, and not evolved from some lower form of animal life.

The unity of human origin is, then, a fact. The Bible declares it, science confirms it. The special creation of our first parents is also a fact.¹ Scripture attests it and science allows it. These facts being admitted, we have eliminated from the discussion two elements of difficulty that we need not further consider.

There was, then, a first man. There was a primeval pair from which all the rest of mankind have descended. Humanity, then, had a birthplace. There was, consequently, a Paradise, a Garden of Eden, as declared by the Scriptures, and as disclosed by the traditions of so many nations and races of men.

But the question again arises: Where was this mother-region of our race? Where was the Garden of Eden of which Genesis speaks? In what part of the world shall we look for this Paradise of delights of which sages have spoken and of which poets have sung? It must have been somewhere on the earth's surface. It will not do to say that such a birthplace for humanity is a myth and never had any exist-

¹ For a fuller discussion of the questions here involved, see my "Evolution and Dogma," part II, chap. 6.

ence. From what precedes, it is clear that such a supposition is not only ungrounded but absurd.

Some have thought that the question could be answered off-hand, from the indications given by the Bible alone. Others have fancied that the data of science were quite sufficient to settle all doubts regarding the matter. Others again are like Hudibras, who

“Knew the seat of Paradise,
Could tell in what degree it lies,
And as he was disposed, could prove it
Below the moon, or else above it.”

In the minds of some the question is encumbered with insuperable difficulties, and a reply to the queries raised is, in the very nature of the case, impossible. In the minds of others, these same difficulties are brushed aside by a majestic wave of the hand, and the exact spot occupied by the Garden of Eden is at once pointed out. There are those who despair of ever knowing more about the matter than we know now, whilst there are others who anticipate the early discovery of some Chaldean tablet, some Accado-Sumerian monument, or some antediluvian record that will give full details and settle, as if by magic, all further controversy.

Truth to tell, there is scarcely a region on the earth's surface in which the Garden of Eden has not been located at one time or other. Some have imagined that it was at the Pole in the “faerie North,” others at the Equator; some have placed it

in Siberia, others in Peru. It has been located in the places now occupied by the Caspian Sea and Lake Van; on the banks of the Ganges, and in the island of Ceylon. Hebron, Damascus, Jerusalem, Babylon have each been considered as situated on the identical spot where our first parents were created and where they fell. According to Credner, the Garden of Eden was in the Canary Islands; according to Hasse, it was in Prussia, on the shores of the Baltic. Herder imagined it to have been in Cashmere; Wellhausen opined that it was farther East; while De Bertheau held that it was in the north of the continent. Livingstone sought for it in equatorial Africa, and hoped to find it at the head waters of the Nile, if he could but be fortunate enough to discover them. Daumer maintained that it was in Australia, whence man emigrated to America, and thence to Asia and Europe by way of Behring's Straits. The terrestrial Paradise of the old Celts was in Avalon, a sea-girt isle of the North; whilst the Paradise of the Jewish commentators who have followed Josephus and mediæval Hebrew exegetists is "in the very center of the earth, somewhere in the shadowy East, far removed from the approach of mortals."

Galindo places the primitive home of our race in the New World; H. L. Morgan makes the valley of the Colombia River the Garden of Eden, the "seed-land of the Ganowanian family," whom, it seems, he regards as autochthonous. Dr. Rudolph Falb, by a

careful study of the Quichua and Aimara languages, fancies that he has discovered such a close relationship between them and the Aryan and Semitic tongues that he is warranted in concluding that we must look to the lofty plateaus of Bolivia and Peru for the cradle of the human race. Professor D. G. Brinton, in a recent lecture, expresses his belief that the first home of our race was either in Western Europe or in Northern Africa.

From the time of Cosmos Indicopleustes, who flourished in the sixth century, to our own, travelers and explorers have sought for the Garden of Eden, and geographers have indicated on their maps the places they imagined it should occupy. Sir John Mandeville, who made his celebrated journey to the East in the early part of the fourteenth century, places Paradise "beyond the land, and isles, and deserts of Prester John's lordship." "Of Paradise," he says, "I cannot speak properly for I was not there. . . . I repent not going there, but I was not worthy." "But," he continues, "Terrestrial Paradise, as wise men say, is the highest place of the earth; and is so high that it nearly touches the circle of the moon there as the moon makes her turn."

Again, he tells us, "You shall understand that no mortal may approach to that Paradise; for by land no man may go, for wild beasts that are in the deserts, and for the high mountains and great, huge rocks that no man may pass by for the dark places

that are there; and by the rivers may no man go, for the water runs so roughly and so sharply, because it comes down so outrageously from the high places above, that it runs in so great waves that no ship may row or sail against it; and the water roars so, and makes so huge a noise, and so great a tempest, that no man may hear another in the ship, though he cried with all the might he could. Many great lords have essayed with great will many times to pass by those rivers toward Paradise, with full great companies; but they might not speed on their voyage; and many died for weariness of rowing against the strong waves; and many of them became blind, and many deaf, from the noise of the water; and some perished and were lost in the waves, so that no mortal man may approach to that place without the special grace of God."¹

Columbus, as we learn from his letters, thought he had found the site of the Garden of Eden, in what is now Venezuela, or Colombia. True, he was not aware that he had discovered a new continent. He was under the impression that he was on the east coast of Asia, the ocean-laved shores of far-off Cathay. He accepted as true the traditional belief which located Paradise in farther India, or yet more to the eastward, and was fully persuaded that he had, in the Orinoco, discovered one of the rivers that watered Eden.

¹ "The Voyage and Travaile of Sir John Mandeville," chap. 30.

Writing to his royal patrons, Ferdinand and Isabella, of the region at the head-waters of the Orinoco, he says: "I have no doubt, that if I could pass below the equinoctial line, after reaching the highest point of which I have spoken, I would find a much milder temperature and a variation in the stars and in the water; not that I suppose that elevated point to be navigable, nor, indeed, that there is any water there; indeed, I believe it impossible to ascend thither, because I am convinced that it is the spot of the earthly Paradise, whither no one can go but by God's permission." Continuing, he adds, "There are great indications of this being the terrestrial Paradise, for its site coincides with the opinions of the holy and wise theologians whom I have mentioned; and moreover, the other evidences agree with the supposition, for I have never either read or heard of fresh water coming in so large a quantity in close conjunction with the water of the sea; the idea is also corroborated by the blandness of the temperature; and if the water of which I speak does not proceed from the earthly Paradise, it appears to be still more marvelous, for I do not believe that there is any river in the world so large or so deep." "The more I reason on the subject," he concludes, "the more satisfied I become that the terrestrial Paradise is situated on the spot I have described; and I ground my opinion upon the arguments and authorities already quoted. May it please the Lord to grant your Highnesses a long life and

health, and peace to follow out so noble an investigation, in which I think our Lord will receive great service, Spain considerable increase of its greatness, and all Christians much consolation and pleasure, because by this means the name of our Lord will be published abroad.”¹

Unger considered Paradise as situated in the lost Atlantis. Ignatius Donnelly does the same. Accepting Plato's account of it, as given in the *Timæus*, as so much veritable history, he attempts to show not only that Atlantis was the Garden of Eden, but that it was also the only possible centre of distribution for the various races which now people the Old and the New World. And more than this. “Not only,” he avers, “was it the original home of mankind, but it was likewise the focus whence have radiated all our cereals and most useful plants and fruits and all our domestic animals.”² Here, too, he claims, many of the most valuable inventions which have ever blessed our race had their origin. In a word, if we are to believe Donnelly, Atlantis was the home of art, science and literature, and the people who inhabited it not only enjoyed all the peace and happiness of which the ancient poets speak as being the lot of the privileged mortals of the Golden Age, but they were the prototypes of the gods, demi-gods and heroes of a later and less fortunate period.

¹ “Select Letters of Christopher Columbus,” translated by R. H. Major, F. S. A., pp. 136-142.

² See “Atlantis, The Antediluvian World,” chap. 9.

M. Mayou, in an ingenious article, in a late number of *La Nouvelle Revue*¹ argues that the Desert of Sahara embraces what was once the Garden of Eden. What is now a bleak and arid waste was once, he believes, a land of marvelous beauty and fertility, watered by large rivers and meandering streams; covered with rich verdure and luxuriant vegetation; densely populated and the happy home of a peaceful and contented people. A new reading of Genesis, in the light of certain hieroglyphical inscriptions of the twelfth dynasty regarding the pyramid of Cheops, will, he assures us, solve the mystery that has so long enshrouded the monument Gizeh, and reveal the reason why all attempts hitherto made to locate the Paradise of Scripture have proved futile. The Nile, he will have it, formerly flowed through Sahara, where it divided into four branches, constituting the quadrifurcate river of Genesis. At this time the people of Egypt, who, even then, were a powerful and a highly civilized nation, suffered from lack of water, and cast about for increasing their supply of this all-important element. They obtained it by deflecting the course of the Nile, and directing it through their own country. By making a large cut or ditch through an elevation near Khartoum, they appropriated to themselves the waters of the great reservoirs of equatorial Africa, and shut off from their neighbors in Sahara the only source of irrigation on which

¹ Les Secrets des Pyramids de Memphis, April 15, 1893.

their country could depend. It was thus man and not God, who closed Paradise, and made entrance into it impossible, by taking from it the water that gave it fecundity and life.

Mr. W. F. Warren, Count Saporta and others, basing their opinions on certain forced interpretations of various ancient legends and traditions, and on the results of scientific explorations of the regions within the Arctic Circle, reach the conclusion that the first home of our race was in the circumpolar North. The investigations of botanists declare the singular, but as yet inexplicable fact, that "all the floral types and forms revealed in the oldest fossils of the earth originated in the region of the North Pole, and thence spread first over the northern and then over the southern hemisphere, proceeding from north to south." The writers just mentioned make the same contention for the world's fauna. And why, they inquire, are we not justified in locating humanity's birthplace where the animals and plants which serve man and on which he subsists and which have accompanied him on his migrations over the earth's surface, are known to have originated? "Only from the circumpolar regions of the North," affirms Count Saporta, "could primitive humanity have radiated as from a centre to spread into the several continents at once and to give rise to successive emigrations toward the south. This theory best agrees with the presumed march of the human

racess." ¹ At the Pole of the earth, therefore, "the sacred quarter" of the world, "the navel of the earth," "the mesomphalos," the *umbilicus orbis terrarum*, are we to look for the long lost Eden, for the cradle of our race. There where the *aurora borealis* is seen in all its splendor, under a canopy formed by palpitating and wafting draperies, quivering curtains, and shining streamers of prismatic hues of matchless brilliancy and varying intensity, our first parents spent the first happy days of their existence and there, amid a frozen desolation lie buried the "hearthstone of humanity's earliest and loveliest home."²

From the foregoing opinions, entertained at various times, the reader can infer how prominent a part wild conjecture, unbridled fancy, and love of learned paradox have played in the numerous investigations which have been made with a view of determining the geographical seat of Paradise. And, be it remembered, allusion has been made to only a few of the opinions that have in times past been promulgated respecting humanity's pristine home. Nearly a hundred different theories regarding the location of the birthplace of our race have been advocated at one time or other, nearly all of which are now discarded as improbable or ridiculous.

Must we, then, look upon the Garden of Eden as

¹ *Popular Science Monthly*, Sept., 1883, p. 678.

² "Paradise Found," p. 433, by W. F. Warren.

a philosophic myth, as many have done, and can we find no place for it but Utopia? Because we refuse to believe that it was located on some elevated plateau of the Andes, or on the top of some mountain in farther India, or in the desert of Sahara, or in the fabled Atlantis, or in some mythical Hyperborean land which has been icebound for the past million years or more, must we abandon all further quest for this "sacred quarter" of the world?

Or, and here we run against another objection, must we believe that such a place is "past finding out," because, forsooth, a certain school of modern scientists will have it that man has been on earth far longer than is commonly supposed according to the traditional view. Must we accept as demonstrated the current teachings regarding the antiquity of our race which are based on a few skulls, flint-flakes, and arrow-heads found in sundry parts of the Old and New Worlds, and conclude that all reputed indications as to man's cradle-land are misleading and that all vestiges of his early sojourn on our planet are obliterated?

In view of the diverse and conflicting opinions that have been held by the foremost exponents of science concerning certain finds which have been made during the past few decades, one should hesitate about giving an affirmative answer to these questions.

Most of our readers are familiar with the controversy that raged a few years ago about the flint-

flakes discovered by Abbé Bourgeois at Thenay, and the proof they were fancied to give to the theory of Tertiary man. Tertiary man is now utterly discredited by all sober-minded scientists. Our readers will remember, too, the sensation occasioned by the discoveries of the Neanderthal man who was variously estimated to have antiquity of from several hundred thousand to less than a hundred years. And they are not ignorant of a discussion which is still going on respecting the age of certain flint-flakes and implements found at Trenton, on the banks of the Delaware, remains which, according to some archæologists, attest for the aborigines of New Jersey an antiquity of ten or twenty thousand years, while other equally competent experts assert that there is not a scintilla of evidence that such remains date back more than a few centuries at most.

Again, no one who makes any pretense of keeping abreast with current discussions in science can be ignorant of a controversy now going on between astronomers, physicists, and mathematicians on the one side, and certain geologists, biologists, and archæologists on the other, regarding a question—the age of the earth—that has a direct bearing on the antiquity of the human species. Lord Kelvin, Professors Tait and Newcomb, George H. Darwin, M. Faye, Clarence King, and others assure us that, reasoning from calculable data, the age of the world, instead of counting hundreds of millions and billions of years, as many geologists and biologists assert, can,

not exceed ten or twenty million years at most, and that, consequently, the period during which man has existed on earth must of necessity be proportionally brief. Until, therefore, geologists, biologists, and archæologists can agree among themselves as to the interpretation of the facts with which their respective sciences deal, and until they can disprove what now seem to be undeniable conclusions of physics, mathematics, and astronomy; until, in a word, they can establish by certain proofs that the traditional view of the recent origin of man is not well founded, we may feel at liberty to maintain that his appearance does not antedate the time assigned to this event by a legitimate interpretation of the Septuagint Version of the Hebrew Scriptures. Such being the case, we have the age of our race reduced from the untold æons of Darwin and Hæckel and De Mortillet to a period that does not cover, at the outside, more than ten or twelve thousand years.

It is easy, then, to see how human history may extend back to our first progenitor; how we may have reliable traditional knowledge of the conditions of life and place of abode of our first parents, and how, in a word, history and tradition, aided by modern research, may enable us to determine, at least approximately, humanity's cradle-land, the Garden of Eden of the Bible.

Just here we encounter another difficulty that requires explanation. Primitive man, it is objected by many modern writers, if not the offspring of some

anthropomorphic ape, if not "descended from a hairy quadruped furnished with a tail and pointed ears, probably arboreal in his habits," as Darwin describes him, was far from approaching the Mosaic or Miltonic ideal which has so long flattered our vanity. Primitive man, far from being the type of physical perfection, and intellectual power, and moral excellence we have been wont to regard him, was, we are assured, but little removed, either in moral or physical characters, from the Ourang-Outang; was as far below certain African and Oceanic negroes as the latter are inferior to the Teutonic or Pelasgic types. These premises being taken for granted, the conclusion is drawn, that if Genesiatic man is a myth, the Garden of Eden is also a myth.

But is it certain that this new view of the condition of primitive man is correct? Is there any evidence that he was the brutal, groveling savage that he is so often pictured to have been; that there was a time when, in the words of a German writer, "people were unable to make any conceivable distinction between a plant and a man"? One can safely and unhesitatingly affirm that there is no more evidence for such a view of primitive man than there is for polygenism, or the simian origin of our race, or for the vast antiquity so often claimed for the human species; theories, which, if not all discredited, certainly do not repose on the firm foundation of thoroughly attested, irrefragable, scientific facts.

So far, not a single fact has been disclosed by the

study of the various races of men, civilized or savage, which cannot be explained as well by retrogression from a higher type, as by development from a lower one; that devolution and subsequent partial progress, it may be, cannot account for as well as evolution. Even Renan is forced to admit that there is not a single example in all history evidencing the passage of any people, by its unaided efforts, from a state of savagery to a condition of civilization. Taking history as our guide, and it is our only safe guide in the premises, we cannot go back to a time when man was either physically or intellectually on a lower plane than he is now; or when he was not capable of as high ethical conceptions as he is to-day; or when his religious nature was less elevated or responsive than it is at present. We may go back to the beginnings of history, and even to the pre-historic past, and man is civilized. This is the lesson taught by the excavations of Schliemann at Mycenæ and Hissarlik, not to speak of similar investigations made elsewhere in the Orient by other explorers. The Egyptians, as we first know them, far from being savages, were the builders of temples and monuments which are still the admiration of the world. Assyria, Chaldea, Babylonia, as shown by the marvelous discoveries in the valleys of the Tigris and Euphrates during the past decades, were not inferior to Egypt in civilization or culture, and there is similarly incontestable evidence for believing that their predecessors, the Accadians and Sume-

rians, were equally enlightened and advanced in all the more important arts of life.

That the antediluvians, and the patriarchs and the immediate descendants of our first common father were less highly endowed physically and intellectually; that their moral and religious conceptions were of a lower order science cannot assert, because science, as science, can know nothing without the aid of history, and history, as just stated, but confirms and amplifies the indications of Scripture.

It is not my purpose to urge the opinion of De Maistre; who contended that the civilization of primitive man was of the most advanced and splendid character; to maintain that Adam and his immediate descendants had all the advantages of what we now denominate civilization; that they enjoyed all the refinements of luxury in the way of food, dress, furniture, habitation, means of locomotion, the product of ages of invention and industry, which are so characteristic of our age; that they were distinguished by the culture of which we boast so much; that they excelled in art or literature, or were noted for their zeal in promoting the cause of science, or forwarding the progress of invention and discovery. Far from it. The civilization which we set so much store by, and which has its drawbacks as well as its advantages, is the fruit of slow and gradual evolution; the accumulated results of hundreds of generations of labor and experience; the heritage developed by the expenditure of thousands of years of

the world's best thought and energy. But what I do maintain is, that primitive man was neither the debased and groveling brute of certain contemporary anthropologists, nor the magnificent savage of Rousseau, a being whose desires were confined to the gratification of his physical needs and passions, who was mild and impassive, and utterly indifferent to either good or evil. Prescinding from the supernatural state to which, according to Scripture, man was raised, and the original grace of which theology speaks, reason and science, not to speak of the unanimous testimony of the ethnic traditions of our race, tell us that man, as he came from the hands of his Creator, was physically a perfect specimen of humanity, endowed with all the gifts of mind and soul necessary to enable him to govern the family of which he was the chief, and to instruct its members in their duties toward God and toward one another. *Homines Sylvatici*, the first men undoubtedly were in the sense that they lived in forests and on plains, and not in palaces and cities. Ignorant they unquestionably were of the most, if not all, of the arts of life that we now deem indispensable. They could neither read nor write. Their language, probably monosyllabic, was undoubtedly of the simplest character. It was, as we may believe, a human invention, and not a divine institution. The Creator undoubtedly endowed man with intelligence and the faculty of speech, and in this sense it may be asserted that language is of divine origin. He gave

man the instrument of speech, but there is no evidence that He did more than this. Still less is there any evidence that He was the immediate Author of the first language spoken by our race, that language for which a certain school of philologists have so long been seeking, and from which, they will have it, all other forms of speech are derived.¹ But, notwithstanding this, they were still, those who were true to the lessons of the father of humanity, physically, morally, and intellectually, the peers, if not the superiors, of any of their descendants. Far from being just a little above the brutes, they were rather but a little below the angels. They were men of perfect physique and of almost god-like intelligence. Considering the degeneracy of the race as compared with the original type, one can truly say of man as he now is, that he is, in the words of Emerson, "but a dwarf of humanity," "a god in ruins."

Again, the much-mooted question as to the geographical seat of Eden comes to the fore. Has

¹ The view that spoken language is a human invention and not a divine institution, is not, as is so often imagined, entirely a modern one with Catholic scholars. It was held and defended by St. Gregory of Nyssa, in the fourth century, as will be seen in his twelfth book "Against Eunomius." The essence of language, as all know, is an intellectual activity known as the *verbum mentale*; while actual speech, the *verbum oris*, is the external manifestation of thoughts by articulate sounds. God undoubtedly gave our first parents the power of speech, the *verbum mentale*, but there is no reason to believe that He also endowed them with the *verbum oris*, and much less that He constructed for their special behoof a complete and perfect language.

modern research done anything toward clearing up the mystery which has so long enveloped the Paradisaic home of our race, or are we to renounce forever all hope of even an approximate solution of the enigma.

Leaving out of consideration the vagaries of certain transformists and polygenists; discarding the dreams of eccentric speculators and paradox-mongers, it may be asserted of a truth that the general consensus of the highest and most trustworthy authorities, in every department of inquiry, is agreed on locating the cradle of humanity somewhere in Western Asia.

Quatrefages, the eminent anthropologist is disposed to consider the lofty plateau of Pamir as the original hearthstone of mankind.¹ This is also the view of the distinguished orientalist, François Lenormant.²

According to Lenormant the four rivers—the Phison, Gehon, Tigris and Euphrates — which watered Gan-Eden or Paradise, were what are now known as the Indus, Oxus, Tarin and Jaxartes. Here, too, curiously enough, on this “Roof of the World,” on this “Central Boss of Asia,” is the spot where the Puranas locate the primeval Aryan Paradise, the holy Mount Meru; the centre, according to Parsi traditions, whence radiated the first Aryan migrations, and one of the regions of the earth which

¹ “The Human Species”, pp. 175-177.

² “Histoire American de l'Orient,” tom. I, p. 104.

even Mohammedan teaching has assigned as the cradle-land of our species.

The theories, however, of Quatrefages and Lenormant, plausible as they may appear from certain points of view, and cleverly advocated as they are by their originators, do not find much favor with the generality of scholars. The concurrent testimony of the majority of investigators who have most profoundly studied the subject unites in proclaiming the basin drained by the Euphrates and the Tigris as the almost certain mother-region of the human family. It is here that the author of Genesis locates the Garden of Eden.

It will not do to say that the testimony of the Bible is ruled out of court, because in the estimation of so many it is regarded as a divinely inspired record. It is here considered simply as a historical document, composed by one who knew whereof he wrote, and whose narrative, humanly considered, bears every indication of having been founded on information that was perfectly reliable, and drawn from traditions which were fresh and carefully preserved by the descendants of the Patriarchs. Neither will it avail to object that the authenticity of the Genesiatic account of Eden has been impaired by modern criticism or proven to be unworthy of credence. Such statements as all know, have been made, but assertion is not proof, conjecture is not demonstration.

Nor again can it be argued that the time which

intervened between the creation of our first parents and the date of the composition of Genesis was so great as to preclude the possibility of simple tradition being adequate to preserve in their integrity all the facts of the Mosaic narrative.

When we realize the power of memory, as illustrated in the conservation and transmission from generation to generation of the noble epics of Homer; when we reflect that the "Rig Veda," which is four times the length of the Iliad, was preserved intact from age to age, and is still preserved by the unaided memory; when we bear in mind that the great body of Vedic literature, stupendous as it is in volume, has been perpetuated and handed down to us by oral traditions despite the fact that the art of writing has been known in India for twenty-five centuries; when we remember that there is yet a class of Hindu priests, who still learn the contents of their sacred books "as their ancestors learnt it thousands of years ago, from the lips of a teacher," we shall experience no difficulty in understanding how the author of Genesis could give an accurate account of what so profoundly affected the first representatives of our race. Only a few generations existed between Adam and Moses, and it would be preposterous to assert that the Hebrew lawgiver could not have an exact traditional knowledge of what took place in antediluvian times, when we know of what wonderful feats the disciplined

memory is capable in other matters that are more difficult and far less important.

Yet more. When we consider how admirably and unexpectedly recent explorations in the valley of the Nile and in the plains of Mesopotamia have illustrated and corroborated so many passages of Holy Writ; how Egyptian inscriptions and Chaldean tablets have illumined and explained what before was unintelligible and seemingly at variance with the known facts of history, we may justly hesitate about accepting the latest hypothesis the "Higher Criticism" may urge against the authenticity of Genesis because, forsooth, some passages in the text may not admit of ready or certain interpretation. And then, too, when we remember what has been accomplished in exegesis since Layard, and Botta, and Smith, and Rawlinson began their epoch-making investigations, we can form some estimate as to what the future has in store in the way of buried records regarding the history of the patriarchal world.

For the reasons indicated, therefore, and for others which need not be specified, we can, I insist, safely trust to the declarations of the Genesiatic narrative regarding the location of Eden, and find in it our best guide toward answering the long-vexed question of humanity's first abode.

In following the Bible it is quite evident that the site of the Garden of Eden must have been somewhere between the sources of the Euphrates and

the Tigris and the *embouchure* of these rivers in the Persian Gulf. There can be no doubt about the topography of Paradise thus far. These two rivers are specially mentioned as among the four which watered the Garden of delights. It is true that Renan and others will have it that the Tigris and Euphrates here mentioned were named after other rivers, probably in Northern India, which, long ages before, were known by these names. It has also been surmised that both of these names were substituted for names entirely different, which have long since been forgotten. There is, however, not the slightest trace of genuine evidence for either of these assumptions. But the great difficulty for those who accept the indications of the Scriptural account of Paradise, and believe that the Euphrates and Tigris of Genesis are identical with the rivers that at present are so named, is the identification of the two other rivers mentioned, viz., the Phison and the Gehon.

Many scholars and theologians, among them the erudite Dom Calmet, locating Eden in the high lands of Armenia, where the Euphrates and Tigris take their rise, have imagined that by the Phison and the Gehon are to be understood the Phasis and the Araxes. But the great objection to this theory is that these rivers, which have entirely different sources and are totally disconnected, can by no legitimate construction of the narrative be considered as being branches of one parent stream.

The distinguished orientalist, Sir Henry Rawlinson, one of the founders of the science of Assyriology, places Eden in the land of Eridu, in Babylonia, a land celebrated in Chaldean hymns both for its great fertility and singular beauty. According to this view, the Djuha, which flowed by the city of Eridu, would be the Gehon, and the Arahter would be the Phison, while the other two rivers, the Tigris and the Euphrates, which now water the plains of Babylonia, are the identical rivers of that name referred to in Genesis. Rawlinson's view is substantially the same as one put forth two centuries ago by Huet, the learned Bishop of Avranches, and maintained by such eminent scholars as Morin, Bochart, and others of their contemporaries. It has much in its favor, but in the present status of the question is less probable than other views that have been advanced.

Some sixteen years ago Friedrich Delitzsch, professor of Assyriology, in Leipsic, published his remarkable book, "*Wo lag das Paradies*," in which he advanced the opinion that the Garden of Eden occupied the same site on which was subsequently built the city of Babylon. According to his theory, which is very ingeniously devised and defended, the Phison and Gehon of Scripture were no other than two canals, the Pallacopas and the Schatt-en-Nil. The former, which was a large and navigable canal, answering to the Phison, started from the Euphrates below Babylon, and following the course formerly taken by the Euphrates itself finally emptied its

waters into the Persian Gulf. The other canal, called by the Arabs Schatt-en-Nil, likewise large and navigable, starts from the left bank of the Euphrates at Babylon and constitutes the Gehon. It afterwards returns to the parent stream near the confines of central and southern Babylonia. In spite, however, of the array of interesting facts marshalled together in support of his thesis and the air of plausibility he has been able to give to his arguments, Delitzsch does not seem to have many supporters of his theory as it was at one time supposed he would have. His proffered explanations of the Genesiatic narrative are often rather suggestions of difficulties that in the present state of knowledge are simply unanswerable.

Going further southward we come to another locality which has often been looked upon as the true site of Paradise. This is the land intervening between the confluence of the Tigris and the Euphrates and the Persian Gulf. Into the Shatt-el-Arab, formed by the union of the Euphrates and the Tigris, flow two other large rivers, the Karun and the Kerkhah, the former of which, it is contended, corresponds to the Phison, and the latter to the Gehon. Both these rivers, as well as the Euphrates and Tigris, admirably conform to the descriptions of them given in the second chapter of Genesis. The Karun especially has all the characteristics of the Phison. Originating in the mountains of eastern Persia, it traverses formations of meta-

morphic and crystalline rocks in which are found not only gold but also the minerals which are supposed to answer to the onyx and bdellium of the Sacred Text.¹

An objection has been urged against this site on the ground that the words of Scripture appear to imply that Paradise was not below the confluence of the four rivers, as this view demands, but rather above the point whence they diverge. To this it may be replied that too much stress seems to be laid on this difficulty which, after all, is more apparent than real. The meaning to be attached to the words will manifestly depend greatly on the location of the author of the Edenic narrative at the time of writing, and the point from which he is supposed to have viewed the site of Paradise. They may therefore be interpreted to mean that Eden was situated below the point of confluence of the four rivers and not above their point of confluence as is generally supposed.

Another objection, and by most people supposed to be an unanswerable one, against locating the Garden of Eden in the basin watered by the Shatt-el-Arab is that the land between the confluence of the four rivers and the Persian Gulf, was at the time of Moses either a dismal uninhabitable marsh or was entirely submerged.

There is, no doubt, good reason for believing

¹ Cf. chap. 4 of "Modern Science in Bible Lands," by J. W. Dawson.

that within historic times the Persian Gulf extended much further northward than it now reaches; that not only much of the southern Chaldean plain was under the sea, but that all the four Paradisaic rivers entered the gulf at different points. This, however, does not invalidate the argument in favor of the Garden of Eden having been located south of the confluence of the Euphrates and the Tigris. For if it is a fact that the country in this section was entirely submerged in early historic times, it is equally certain that since the advent of man on earth the Babylonian plain extended much further southward than it does at present. For there is incontestable geologic proof that in the beginning of the human period not only were Europe and Western Asia more elevated than they now are, but also that much of the northern portion of the Persian Gulf was occupied by dry land, much higher and better drained than the land which now borders the sea in this vicinity. At the close of the Pleistocene period, and prior to the appearance of man, the Shatt-el-Arab was longer than it is at present; the country through which it passed was not only elevated above its present level, but was also, as we may conceive, highly fertile, well wooded and covered with luxuriant vegetation of a subtropical character. The climate was mild and equable and the environment was all that could be desired to make this spot an ideal home for the first representatives of our race.

Such a view does not, as may be urged, neces-

sarily presuppose a greater antiquity for man than orthodoxy is willing to concede. The elevation and depression of the northern coast line of the Persian Gulf do not, as the Uniformitarian school of geologists contend, imply the æons which have been claimed for them. On the contrary, as has been demonstrated by the recent investigations of Howorth and Prestwich,¹ there have been since the advent of man on earth abrupt and transitory elevations and subsidences over large continental areas. At the close of the "Mammoth Age" which was subsequent to the appearance of man, according to most geologists, there was, says Howorth, "a very violent and wide-spread dislocation of the earth's crust, which led to the upheaval of some of the loftiest mountain chains," and with this, as he supposes, was immediately connected the latest epoch of mountain building, by which the Himalayas and Cordilleras, the Ural, Altai and Thian-Shan Mountains were tilted up to their present heights. "Such an upheaval," he asserts, "was accompanied by an equally rapid and substantial subsidence in other places, of which there is much evidence."²

Here, then, at the long last, we have found the object of our quest. In the basin drained by the Shatt-el-Arab, on the northern border of the Per-

¹ Cf. Prestwich in the "Proceedings of the Royal Society," vol. liii., 1893, and his interesting little book, "The Tradition of the Flood." See also Howorth's two learned works, "The Mammoth and the Flood," and "The Glacial Nightmare and the Flood."

² *Geological Magazine*, 1892, p. 63.

sian Gulf, at the extreme south of old Babylonia, so famous in history, the theater of so many political, social and religious revolutions, and the trysting place of humanity's first intellectual jousts, must we locate the Garden of Eden. Here, too, we find the prototype of the Elysian Fields, the Gardens of the Hesperides, the Isles of the Blessed, the Olympus, the Center of the Earth, the Omphalos, of which poets have sung and of which all peoples have their traditions.¹

This sacred spot, while answering fully to the description of the Genesiatic narrative, at the same time meets all the requirements of theology and satisfies all the exigencies of history and science.

¹ After the above was in print, I was pleased to find what is essentially a confirmation of the views advocated in this paper, in the latest work of the illustrious Orientalist, Prof. A. H. Sayce, of Oxford. In "The Higher Criticism and the Verdict of the Monuments," p. 95, this distinguished scholar writes of the site of Eden as follows:

"The scenery, however, is entirely Babylonian. The Eden itself, in which the garden was planted, was the plain of Babylonia. This we now know from the evidence of the cuneiform texts. It was called by its inhabitants the Edinn, a word borrowed by the Semites from the Accado-Sumerian *edin*, 'the (fertile) plain.' To the east of it lay the land of the 'Nomads,' termed Nod in Genesis, and Manda in the inscriptions. The river which watered the garden was the Persian Gulf, known to the Babylonians as 'the river,' or, more fully, 'the bitter' or 'salt river.' It was regarded as the source of the four other rivers whose 'heads' were thus at the spots where they flowed into the source which at once received and fed them."

This is also the view, as I have learned since the above was written, which is entertained by Professor Haupt, of Johns Hopkins University, and by the Abbé Dessailly in his exhaustive work, "Le Paradis Terrestre et la Race Nègre." On page 312 of this book he writes, "Le Paradis était placé sur un fleuve unique; nous le plaçons sur le beau et majestueux fleuve du Chatt-el-Arab."

All the indications of authentic history point to this spot as the cradle of our race. It was here indeed that history was first written; it was in this land that the first libraries were formed; it was in the capitals of Mesopotamia that literature essayed its earliest flights.

From this spot went forth those streams of humanity that have long since reached every nook and corner of the habitable earth. From this quarter of the globe have come all our most useful plants and cereals, wheat, rye, oats, barley, and most of our domestic animals. Hence have proceeded the cow, the hog, the sheep that supply us with food and clothing; the horse, the ass, and the camel, that carry our burdens, and the ever faithful dog, man's vigilant protector and friend.

It is toward this point that all the lines of human thought converge as to their natural center. Thither must linguistics look for a solution of many of its riddles. To this favored portion of the world must ethnology go if it would read aright the affiliations of the various races and the countless tribes of human kind. Here alone have the traditions of the great Euphratean valley their proper interpretation, and here alone have the myths which have so long puzzled Orientalists their full significance.

The Garden of Eden is not, then, "a bit of mythical geography," as it has so often been denominated. It is a fact, and one of the most interesting and important and suggestive facts of all

history; the open sesame which explains many facts that were else an enigma; the thread of Ariadne that prevents us from losing ourselves in "the labyrinth of fanciful theories and in the chaos of clashing opinions," in which the lot of the modern searcher after truth is cast.

No; the story of the Garden of Eden is not, I repeat it, a mere fiction. It is a trustworthy narrative, which, in the words of a distinguished French writer, "gives us, under the form of infantine poesy, the first page of the moral history of humanity; of that history which has for documents not simply a few flints, more or less perfectly fashioned, but all that survivance of a divine life in the human soul manifested by its aspirations and its dolors, and by that universal sentiment of forfeiture which is evidenced in all mythologies, and which is the dominant aspiration of all religions."

And, strange irony of fate! It is in close proximity to the spot here indicated for the seat of Paradise that those who are most opposed to the Biblical account of man's origin have been compelled, by the overmastering indications of science, to locate the birthplace of our race. For not far to the south of the lower Euphratean basin is situated Hæckel's hypothetical Lemuria,¹ a submerged continent of which, as already stated, there is no satisfactory evidence, and whose existence, even if proven, would throw no more light on the Biblical

¹ "History of Creation," vol. 1, p. 361, and vol. 2, p. 326.

Eden than is afforded by the area contended for in this chapter. Where the Euphrates, therefore, empties its waters into the Persian Gulf, or at a point not far remote, was it that "the Lord God planted a Paradise of pleasure from the beginning, wherein he placed man whom he had formed."¹ This is the sacred spot which tradition, history, and science, with no uncertain voice, designate as the land wherein lived the men of the "Golden Age," as humanity's first and fairest and happiest home.

¹ Genesis, II, 8.

